

RELATIONSHIP 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 Body Mass Index (BMI), 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) and BMI of the respondents were measured using calcaneal quantitative ultrasound (QUS) by using Sonost-3000 machine and weighing scale (SECA 767) respectively. From the independent sample T-test, there was a significant difference in the BMI categories ($p = .022$), eating attitude ($p = .041$), physical activity ($p = .013$) and BMD ($p = .012$) between male and female students. While from the Pearson correlation analysis, there was a weak relationship of BMI and BMD ($r = .292$), negative 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 about how BMI, eating attitude and 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), Body Mass Index (BMI), 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 contribute 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). 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), also 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. Thus, this study aimed to examine the relationship of BMI, eating attitude and physical activity on bone health among undergraduate students in the Faculty of Educational Studies in Universiti Putra Malaysia (UPM).

2. METHODS

2.1. Participants

Respondents for this study are among undergraduate students from Faculty of Educational Studies. Their age range is 18 to 27 years old.

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 mainly used quantitative and correlational study design. Approval letter to conduct the study was obtained from the university's Human Ethics Committee before actual study. Besides that, the researcher made a letter to the Faculty of Educational Studies to know the exact number of population. Next, a pilot study had been conducted and after that the actual study was done following the same protocol.

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, whereby 149 were female and 132 were male. Therefore, the frequencies and percentage of BMI, eating attitude, physical activity were measured based on the total of Metabolic Equivalent Test (MET) and BMD is shown in Table 1. Next, analyses revealed that there was a significant difference in the BMI categories among male and female students $t(279) = 2.52; p < 0.05$ (Table 2). While, the relationship of BMI, eating attitude and physical activity among the undergraduate

students in the Faculty of Educational Studies was investigated using the Pearson correlation test. Table 3 shows the correlation value of all dependent variables on the BMD.

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 normal level and lower at osteoporosis level.

Table 2. Comparison of BMI, Eating attitude, Met 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 ($t(279) = -2.00$; $p < 0.05$, 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 MET 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, EAT-26 and MET level 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 (Rahim, 2007).

Next, in term of eating attitude the result showed that most of the male respondents having normal or not prone to have eating attitude disorder than female respondents. The finding of this present study was in line with the studies by Sue & Wan (2012), Birlil, Zhang & McCoy (2012) and Kuan et al; (2011) where they indicated that eating disorder attitude among female 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). Besides that, according to Roblin (2007), frequent intake of junk food and high densed calorie snacks such as 'kerepek', inadequate intake of vegetables, fruit, and milk, among the Malaysian Malays has put them at risk in maintaining normal body weight.

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 female showed a significantly higher rate in performing brisk walking 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 equipment. (Abadi, Muhammad & Salamuddin. 2010). However, level of physical activity among young adults, especially university students are still not sufficient. 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). Contrary with a study by Poh, Safiah, Tahir, Siti, Siti, Norimah, Wan, Mirnalini, Zalilah, Azmi & Fatimah (2010), found out that the physical activity pattern

of both males and females are similar, males spends more time on sleeping and sport activities while females more on chatting with friends and personal care activities.

Besides that, the results showed that female respondents have higher significantly normal level of BMD than male. These findings were supported by the studies 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 a 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 (Sham et al., 2013). This fact was for the comparison to male students whom were clearly demonstrated the lack of knowledge towards positive bone health status and osteoporosis prevention (Wan et al., 2010).

This study also showed that the BMI categories, 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 Elsayy & Header (2014) high 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. 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.

Next, based on the negative relationship between the eating attitude and BMD explained that the lower score of the EAT-26 the higher 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 as non-athletes and athletes 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 MET or 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, they stated that physical activity was effective to help minimise 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 the BMI categories, 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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