

Fracture Risk Factor in Post-Menopausal Women with Deterioration of Bone Density

Abstract

Background: Most of the aged women experience the deterioration of bone due to the gradual decrease in bone mineral density (BMD). According to different studies, a continuous progressive decline in bone density results in risks of fractures. **Aims:** The study aimed to identify the fracture risk factors among post-menopausal women with the deterioration of bone density. **Settings and Design:** Cross-sectional study design was used, and was conducted clinic at Hospital Tengku Ampuan Afzan (HTAA) Kuantan, Pahang, Malaysia. **Methods:** In total, 116 post-menopausal women were selected as a sample from a public hospital in Malaysia. An assessment checklist on fracture risks; including age, menopause year, BMD, serum calcium level, balance and gait score, body mass index (BMI) was used to collect data. Descriptive statistics and Pearson correlation were used to analyze data. **Results:** Findings showed that 87.1% participants confidently performed daily activities. Normal TUG score was revealed for 76.7%, and Fall Free Prevention Questionnaire (FFPQ) findings show that no risk of falling prevailed. Pearson correlation showed negative weak correlation between BMD with the age of respondents, year of menopause and TUG ($r = -.373$), ($r = -.284$) and ($r = -.237$). Moderate correlation was found between BMD in BMI status ($r = .343$) and weak correlation was found between BMD and ABC scale ($r = .200$). **Conclusions:** The study emphasized on instigation of the intervention to improve population literacy related to menopause and bone density deficiency.

Keywords: Body mass index, bone density, Malaysia, menopause

Introduction

Women are said to be the principle and more vulnerable group to the primary osteoporosis subcategory of Involutional Osteoporosis Type I, which occurs postmenopausal, as an outcome of low estrogen that adversely affects the trabecular bone.^[1] Reduced estrogen in the menopause causes a detrimental effect on the bone-building cells, which impacts the natural procedure of the bone breakdown and repair. Thulkar *et al.*^[2] indicated age, nutrition, education level, physical movement, and weight as most common risk factors for osteoporosis. Since change in the genetic factor is impossible to yield, the presence of adjustable factor is required for sustaining bone strength and bone density that assists in mitigating the osteoporosis and fracture risk.^[3]

The ability of bone to withstand trauma is significantly influenced by the bone geometry and microarchitecture. Bone

mineral density (BMD) relates to 75–90% of variance in bone strength.^[4] World Health Organization (WHO) provided the criteria of T-score and z-score to evaluate bone status. The number of standard deviations falling below the young adult mean value in osteoporosis is explained as T-score, whereas expected BMD for individual's sex and age is characterized as z-score and the correlation between both the scores represents BMD.^[5] However, Malik^[6] indicated that early bone changes among post-menopausal women can also be detected through salivary calcium.

In 2010, a high potential of osteoporosis was reported to be associated with 137 million women and 21 million men, among which 55% belonged to Asia.^[7] A study by Chin *et al.*^[8] reported growing occurrence of osteoporosis and osteopenia in Malaysian women since the bone mass of the women is comparatively lower than men. Despite the presence of numerous management strategies, osteoporosis accounts for increased morbidity and mortality, given its late diagnosis and treatment. It is because

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osteoporosis is a silent illness, and with no existing symptoms until the occurrence of the bone fractures.^[9]

Most of the researchers conducted in Malaysia are restricted to a certain ethnic group.^[10,11] Thereby, the study aims to identify the risk factors of fracture in post-menopausal women with the deterioration of bone density in Malaysia. The measurement of bone mass density can enable early treatment and diagnosis of the post-menopause women, which WHO has acknowledged as the best osteoporosis and fracture predictor.^[12] This study assists healthcare experts in improving the bone density status among post-menopause women in Malaysia.

Methods

Study design and population

It is a cross-sectional study involving women (≥ 50 years) with menopause who visit Orthopedic and, menopause clinic at Hospital Tengku Ampuan Afzan (HTAA) Kuantan, Pahang, Malaysia in April until October 2016. A purposive sample of menopausal women was recruited. The exclusion criteria included women that have been previously diagnosed with bone-altering metabolism or have received therapeutic treatment of the bone fracture. Patients who require assistance in walking, or experience mobility challenges, and have undergone fracture six months before the study were also excluded. The criteria for selecting respondent were based on BMD. The selection of 116 participants is further detailed out in Figure 1.

Data collection

Data collection was performed after obtaining the approval from the International Islamic University Malaysia Research Ethics Committee (IREC) (IIUM/305/14/11/2/

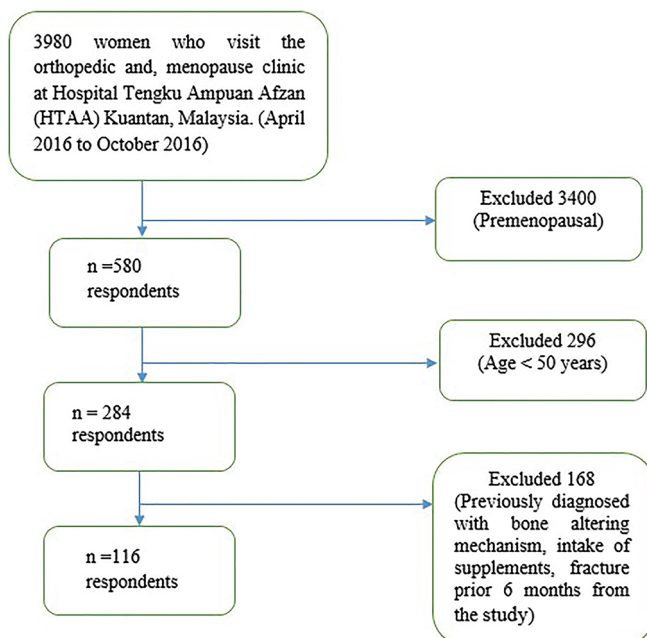


Figure 1: Flow chart for selection of participants

IREC509) and National Medical Research Registry (NMRR) (15-1794-27755) which helps in conduct of research based on guidelines set by the Ministry of Health Malaysia. Respondents were assessed via a questionnaire about independent risk factors for fracture. These risk factors include; age, years of menopause, activity specific and balance scale (ABC), and Fall Free Prevention Questionnaire (FFPQ). A trained radiographer conducted BMD test in HTAA with the use of Hologic Discovery DEXA machine for measuring axial skeletal sites of the spine and appendicular skeleton of the hip. Physical examination was done using BC541 Inner scan Body Composition Scale Tanita and Body Scale M-400 for body mass indexes (BMI) measurement. Assessment physical was conducted on balance and gait by using Time Up and Go (TUG) assessment followed by blood investigation on serum Calcium.

Data analysis

Data management and analysis were performed using IBM SPSS Version 20.0. Descriptive data were generated for all variables. Pearson correlation test was carried out to determine the relationship between BMD status and all of the independent variables on the fracture risk factor. Correlations were considered significant at a value of $P < 0.05$.

Ethical consideration

An informed consent was obtained from participants before commencing to the data collection process. Participants were explained about the purpose of this study, and confidentiality of their information was further ensured. An approval from the Institutional Review Board (IRB) of the hospital was also obtained.

Results

Table 1 shows the variables of fracture risk factors where participant's mean age was 62 ($SD \pm 7.87$), and the mean value for menopausal years was 12.13 ($SD \pm 8.20$). Overall, 52.6% ($n = 61$) of the participants were suffering from osteopenia. Fracture risk factors also consist of BMI of respondents, which showed that 52.6% ($n = 61$) respondents had normal weight.

Table 1 also indicates the assessment of certain variables of fracture risk factors which includes; confident level (ABC score), TUG score, and fall prevention (FFPQ). The findings showed that 87.1% ($n = 101$) participants were confident enough while doing their daily activities, 76.7% ($n = 89$) were had normal TUG score, and most of the participants 77.6% ($n = 90$) had greater risk of falling, as shown in FFPQ findings.

For 116 participants, the Pearson correlation coefficient was computed to assess the relationship between BMD status and fracture risk factor variables. There was a negative weak correlation between BMD with the age

Table 1: Variables of fracture risk factors and respondents

Variables	n	%	Mean±SD
Age	116		61.84±7.87
50-59	54	46.6	
60-69	41	35.3	
Above 70 years	21	18.1	
Years of Menopause			12.13±8.20
10-19	42	36.2	
20-29	17	14.7	
30-39	4	3.4	
40-49	1	0.9	
BMD status			-2.3±0.84
Osteopenia	61	52.6	
Osteoporosis	55	47.4	
FRAX BMI			23.36±4.30
Underweight	14	12.1	
Normal weight	61	52.6	
Overweight	32	27.6	
Obese	9	7.8	
Calcium level			
Normal	111	95.7	
Low	5	4.3	
ABC Scale - Confident level			
High	101	87.1	90.94±16.44
Moderate	9	7.8	
Low	6	5.2	
TUG - Balance and Gait			
Normal	89	76.7	11.65±3.96
Abnormal	27	23.3	
FFPQ - Risk for Fall			
Low risk	26	22.4	
Greater risk	90	77.6	

ABC=Activity specific and balance scale, TUG=Time Up and Go, FFPQ=Fall Free Prevention Questionnaire

of respondents, year of menopause and TUG ($r = -.373$, $P = 0.001$), ($r = -.284$, $P = 0.001$) and ($r = -.237$, $P = 0.010$), respectively. However, a moderate correlation was found between BMD and BMI status ($r = .343$, $P = 0.001$). In addition, a weak correlation was found between BMD and ABC scale ($r = .200$, $P = 0.032$); subsequently, there was no significant correlation found between BMD with serum calcium ($r = -.156$, $P = 0.094$) and FFPQ ($r = -1.24$, $P = 0.184$).

Discussion

The study has identified the fracture risk factors among post-menopausal women. The results of the study revealed that increased age and menopausal years among post-menopausal women were correlated to decreased BMD. Also, that the progressing age was positively and significantly correlated (0.001) with a lower bone density among the Indonesian women. Similarly, a research conducted in Korea by Na *et al.*^[13] found positive correlation between increased age of post-menopause

women and increased occurrence of fracture. Also, a study by Shivappa *et al.*^[14] conducted on the Chinese population showed that increased prevalence of osteoporosis (59.3%) was found in women compared to men (21.7%) among 75 to 79 years age group. It is because women tend to suffer from escalated bone loss following menopause.^[15]

The negative association in age and menopausal years with the body mass density status suggested that most of the respondents are aged above 50 years as referred by a mean age of 61.84 years. 2q correlation of BMD between the years of menopause is one of the remarkable findings in this study. The pathogenesis of osteoporosis in women likely involves augmented bone resorption by osteoclasts, related to changes in estrogen levels at menopause.

The study demonstrated that bone density was significantly and moderately correlated with the BMI of the respondent. Consequently, low BMI showed that the respondents were having a low density of bone. Crandall *et al.*^[15] and Johansson *et al.*^[16] have indicated that the influence of body weight on the risk of fracture is complex. Low body weight is considered as a risk factor for osteoporotic fracture. However, a high proportion of postmenopausal women with low trauma fractures were obese.^[17] This emphasizes that women should control the intake of nutrition to prevent the osteoporosis in later middle age.

These findings suggested that serum Calcium and FFPQ (risk for fall) were not main contributing factors to the fracture risks in the context of Malaysia. These are corroborated by the findings of Bolland *et al.*^[18] which showed that calcium intake does not affect bone density. Thus, the study strongly suggested that early detection and prevention is helpful to identify the common factors, related to fracture risks among post-menopausal women. Post-menopausal women have faced a severe risk of getting fragility fracture as advancing age and years of their menopause.

The limitation of the study includes its restriction to Malaysia, which limits its results transferability to other countries, given the variant socio-economic status. Moreover, the data was collected from a clinic and hospital regulated under the same name, therefore, future studies can collect data from various organizations across different regions. Furthermore, the sample size was limited and few factors were studied.

The findings of the study necessitate intervention in the form of anti-inflammatory regimes for preventing osteoporosis and public health burdens in women. The assessment for BMD is needed to be performed for every patient who is assumed to indicate an increased osteoporosis potential. In addition, awareness is required to be imparted for the physical activity, intake of nutrition, and bone-healthy associated behaviors which are required to identify the bone disease risk and fracture.

This study provides the knowledge on fracture risk factor associated with post-menopause women in Malaysia adjusted for various demographic factors, menopause years, and BMI status. The study concluded that a decrease in bone density increases the risk fracture among menopausal women. The findings highlighted that an increase in bone density deficiency is associated with menopause duration and age, leading to escalated fracture risk. The study also revealed that BMI status is an important variable which affects the bone density. However, no impact on bone density was observed for serum calcium and FFPQ. The study directs future researches to collect updated data on fracture risk assessment in order to establish strategies to prevent osteoporosis in Malaysian post-menopausal women.

Ethical approval

Ethical approval was taken from the International Islamic University Malaysia Research Ethics Committee (IIUM/305/14/11/2/IREC509) and National Medical Research Registry (15-1794-27755).

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of patient consent

An informed consent was obtained from participants before commencing to the data collection process.

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Conflicts of interest

There are no conflicts of interest.

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References

1. Sözen T, Özışık L, Başaran NÇ. An overview and management of osteoporosis. *Eur J Rheumatol* 2017;4:46-56.
2. Thulkar J, Singh S, Sharma S, Thulkar T. Preventable risk factors for osteoporosis in postmenopausal women: Systematic review and meta-analysis. *J Midlife Health* 2016;7:108-13.
3. Irmayati S, Reagan M, Legiran L. Sleep and bone density: A study on postmenopausal Indonesian women. *Bioscientia Medicina* 2019;3:38-50.
4. Holroyd C, Cooper C, Dennison E. Epidemiology of osteoporosis. *Best Pract Res Clin Endocrinol Metab* 2008;22:671-85.
5. Poursmaeili F, Kamalidehghan B, Kamarehei M, Goh YM. A comprehensive overview on osteoporosis and its risk factors. *Ther Clin Risk Manag* 2018;14:2029-49.
6. Malik AR. Assessment of salivary calcium level in post-menopausal women. *JAMDSR* 2019;7:111-3.
7. Oden A, McCloskey EV, Kanis JA, Harvey NC, Johansson H. Burden of high fracture probability worldwide: Secular increases 2010–2040. *Osteoporos Int* 2015;26:2243-8.
8. Chin KY, Kamaruddin AA, Low NY, Ima-Nirwana S. Effects of age, sex, and ethnicity on bone health status of the elderly in Kuala Lumpur, Malaysia. *Clin Interv Aging* 2016;11:767-73.
9. Mohammadi F, Hamid TA, Yazid MN, Othman Z, Mahmud R. Lifestyle factors influencing bone mineral density in postmenopausal Malaysian women. *Life Sci J* 2011;8:132-9.
10. Baron R, Hesse E. Update on bone anabolics in osteoporosis treatment: Rationale, current status, and perspectives. *J Clin Endocrinol Metab* 2012;9:311-25.
11. Ohn Mar S, Malhi F, Syed Rahim SH, Chua CT, Sidhu SS, Sandheep S. Use of alternative medications for menopause-related symptoms in three major ethnic groups of Ipoh, Perak, Malaysia. *Asia Pac J Public Health* 2015;27:19S-25S.
12. Senn C, Günther B, Popp AW, Perrelet R, Hans D, Lippuner K. Comparative effects of teriparatide and ibandronate on spine Bone mineral density (BMD) and microarchitecture (TBS) in postmenopausal women with osteoporosis: A 2-year open-label study. *Osteoporos Int* 2014;25:1945-51.
13. Na W, Park S, Shivappa N, Hébert JR, Kim MK, Sohn C. Association between inflammatory potential of diet and bone-mineral density in Korean postmenopausal women: Data from fourth and fifth Korea national health and nutrition examination surveys. *Nutrients* 2019;11:885.
14. Shivappa N, Hébert JR, Karamati M, Shariati-Bafghi SE, Rashidkhan B. Increased inflammatory potential of diet is associated with bone mineral density among postmenopausal women in Iran. *Eur J Nutr* 2016;55:561-8.
15. Crandall CJ, Yildiz VO, Wactawski-Wende J, Johnson KC, Chen Z, Going SB, et al. Postmenopausal weight change and incidence of fracture: *Post hoc* findings from Women's health initiative observational study and clinical trials. *BMJ* 2015;350:h25.
16. Johansson H, Kanis JA, Odén A, McCloskey E, Chapurlat RD, Christiansen C, et al. A meta-analysis of the association of fracture risk and body mass index in women. *J Bone Miner Res* 2014;29:223-33.
17. Premaor MO, Pilbrow L, Tonkin C, Parker RA, Compston J. Obesity and fractures in postmenopausal women. *J Bone Miner Res* 2010;25:292-7.
18. Bolland MJ, Leung W, Tai V, Bastin S, Gamble GD, Grey A, et al. Calcium intake and risk of fracture: Systematic review. *BMJ* 2015;351:h4580.