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Original research

PREVALENCE AND RISK FACTORS OF OSTEOPOROSIS AMONG WOMEN AGED 35 TO 65 IN DA LAT CITY, LAM DONG PROVINCE

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ABSTRACT

Background: *Osteoporosis is a progressive condition characterized by decreased bone mineral density (BMD), leading to increased bone fragility and fracture risk. This study aimed to assess the prevalence of osteoporosis and identify associated risk factors among women aged 35 to 65 in Da Lat City, Lam Dong Province.*

Methods: *A cross-sectional descriptive study was conducted on 497 women who had resided in Da Lat for at least three years. Osteoporosis was diagnosed based on BMD measurements, using the T-score criteria of the World Health Organization (WHO) for women aged 50 and older and the Z-score criteria of the International Society for Clinical Densitometry (ISCD) for those under 50.*

Results: *The prevalence of osteoporosis was 5.8% at the femoral neck and 4.0% at the lumbar spine. Multivariate analysis identified two significant risk factors: inadequate physical activity (OR = 2.68; 95% CI: 1.08 - 6.65; p = 0.033) and overweight - obesity (OR = 3.61; 95% CI: 1.38 - 9.46; p = 0.009).*

Conclusion: *The study highlights the need for increased public health efforts to promote physical activity and weight management as key strategies for osteoporosis prevention. Raising awareness and encouraging lifestyle modifications could help reduce the risk and burden of osteoporosis among women in this age group.*

Keywords: *Osteoporosis, bone density, women.*

I. INTRODUCTION

Osteoporosis is a condition characterized by decreased bone mineral density (BMD), leading to fragile bones and an increased risk of fractures. Globally, osteoporosis is responsible for approximately 8.9 million fractures each year, including 1.66 million hip fractures. Projections suggest that by 2050, over 50% of hip fractures in Asia will be attributable to osteoporosis. The prevalence of osteoporosis among women in Asian countries varies between 27.1% and 51.6%, with a sharp increase observed in perimenopausal and postmenopausal women due to estrogen deficiency [1].

Previous studies have documented the high burden of osteoporosis in Vietnam. For instance, research conducted by Tran Thua Nguyen and Tran Bui Hoai Vong reported a 15% prevalence of osteoporosis among women aged 40 and older seeking care at Hue Central Hospital [2]. Without timely detection and appropriate treatment, osteoporosis significantly raises the risk of fractures, particularly in the spine and femoral neck, leading to severe physical, psychological, and economic consequences. The risk of osteoporosis increases with age, posing challenges to public health by reducing quality of life, increasing healthcare costs, and impacting economic productivity.

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Given the rising incidence of osteoporosis and its serious implications, early detection and preventive strategies are crucial. This study aims to: (1) determine the prevalence of osteoporosis among women aged 35 to 65 in Da Lat City, Lam Dong Province, and (2) identify key factors associated with osteoporosis in this population.

II. METHODS AND MATERIALS

2.1. Subjects

Women aged 35 to 65, have lived in Da Lat City, Lam Dong province for 3 years and more. Women with chronic liver failure, kidney failure, malignancy, deafness, and mental illness were not included in the study.

2.2. Methods

This study employed a cross-sectional descriptive design with a sample size estimated using the formula for estimating a population proportion

$$n = \frac{Z^2_{(1-\alpha/2)} \times p(1 - p)}{d^2}$$

With a 95% confidence level ($Z_{(1-\alpha/2)} = 1.96$), an expected proportion p = 0.15 [2], and a margin of error d = 0.05, the minimum required sample size was calculated to be 196; after adjusting for a design effect of DE = 2 and an anticipated 20% sample loss, the final estimated sample size was 470, and the study was conducted on 497 women.

A two-stage stratified sampling method was employed. In the first stage, four wards/communes in Da Lat City were randomly selected based on residential characteristics, including Ward 9 (located in the city center), Wards 4 and 7 (adjacent to central wards), and Ta Nung Commune (located in the outskirts). Due to the relatively similar population sizes among these selected areas, a nearly equal number of participants were recruited from each: 127 women from Ward 9, 121 women each from Wards 4 and 7, and 128 women from Ta Nung Commune.

Assessment criteria: Bone density was assessed using the OsteoPro Grand machine, produced by Yozma BMTech in 2017, known for its high-resolution imaging and fast scan speeds with low radioactivity exposure; osteoporosis diagnosis for women aged 50 and over followed WHO standards (1994) based on the T-score (≥ -1.0: normal; -2.5 to -1.0: decreased bone density; ≤ -2.5: osteoporosis; ≤ -2.5 with a history of fracture: severe osteoporosis) [3]. while for women under 50, the International Society for Clinical Densitometry (ISCD) used the Z-Score (≤ -2.0: osteoporosis; > -2.0: normal) for diagnosis.

2.3. Study ethics

This study was approved by the Ethics Council in Biomedical Research at Hue University of Medicine and Pharmacy (H2022/352), the Lam Dong Provincial Department of Health, and the Lam Dong Provincial General Hospital. Informed consent was also obtained from all women who participated in the study.

III. RESULTS

The study sample consisted mainly of women aged 55 - 65 (35%). Most had a high school education (75.1%) and were not employed (80.7%). Overweight/obesity was seen in 44.5%, and 51.9% engaged in physical activities. Menopausal women and those not yet menopausal were nearly equally represented (47.5% vs. 52.5%) (table 1).

In terms of obstetric and medical history, most women had ≤ 2 pregnancies (50.7%) and 2 full-term births (57.1%). 22.9% had bone and joint diseases, and 1.2% had a previous fracture (table 2).

Table 1: Some characteristics of 35 - 65 year old women

Characteristics		n	%
Age group	35 - 44	161	32.4
	45 - 54	162	32.6
	55 - 65	174	35.0
Educational status	High school	373	75.1
	Undergraduate/Postgraduate	124	24.9

Characteristics		n	%
Occupational status	Employed	96	19.3
	Other	401	80.7
Nutritional status (BMI)	Underweight	18	3.6
	Normal	258	51.9
	Overweight/Obesity	221	44.5
Menopausal status	Menopausal	236	47.5
	Not yet menopausal	261	52.5
Alcohol consumption at harmful levels	Yes	42	8.5
	No	455	91.5
Physical activities	Yes	258	51.9
	No	239	48.1

Table 2: Obstetric and medical history

Characteristic		n	%
Number of pregnancies	≤ 02 times	252	50.7
	03 times	120	24.1
	≥ 04 times	125	25.2
Number of full-term births	≤ 01 times	57	11.5
	02 times	284	57.1
	≥ 03 times	156	31.4
Bone and joint diseases	Yes	114	22.9
	No	383	77.1
Previous fracture	Yes	6	1.2
	No	491	98.8

Osteoporosis status among women aged 35 - 65 in Da Lat City: The prevalence of osteoporosis is 5.8%, with 94.2% not affected. The prevalence of osteoporosis is 4%, with 96% not affected (Figure 1). According to BMD at the lumbar spine and femoral neck, the 55 - 65 age group had the highest rates of osteoporosis, 75% and 69%, respectively (table 3).

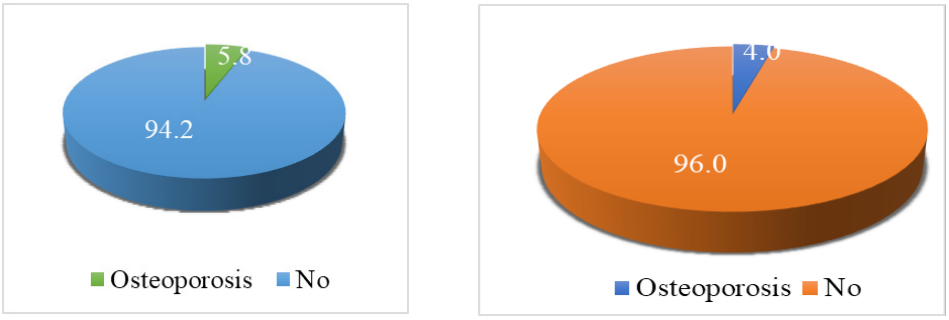

Figure 1: The prevalence of osteoporosis based on bone mineral density assessment at the femoral neck based on bone mineral density in the lumbar spine among women

Table 3: Classification of osteoporosis according to age group

Osteoporosis in the lumbar spine (n = 20)	**(n)**	**(%)**
35 - 44	2	10.0
45 - 54	3	15.0
55 - 65	15	75.0
Osteoporosis in the femoral neck (n = 29)	**(n)**	**(%)**
35 - 44	2	6.9
45 - 54	7	24.1
55 - 65	20	69.0

A relationship exists between physical activity, overweight - obesity, and osteoporosis ($p < 0.05$) (table 4).

Table 4: Osteoporosis - related factors according to multivariate logistic regression

Factors		**OR**	**95% CI**	**p**
Age group	35 - 44	1		
	45 - 54	3.47	0.44 - 27.26	0.236
	55 - 65	1.34	0.41 - 4.35	0.627
Educational level	High school	1		0.277
	Undergraduate/Postgraduate	2.48	0.48 - 12.75	
Occupational group	Employed	1		0.619
	Others	1.75	0.19 - 15.75	
Menopausal	Yes	1		0.397
	No	1.91	0.47 - 8.56	
Number of pregnancies	≤ 02 times	1		
	03 times	7.62	0.81 - 71.52	0.075
	from 04 times	3.12	0.33 - 29.32	0.320
Number of full-term births	≤ 01 time	1		
	02 times	1.71	0.48 - 6.09	0.410
	≥ 03 times	0.32	0.03 - 3.67	0.359
Bone and joint diseases	Yes	1.36	0.56 - 3.30	0.502
	No	1		
Previous fracture	Yes	6.25	0.73 - 53.63	0.095
	No	1		
Physical activities (as recommended)	Yes	1		0.033
	No	2.68	1.08 - 6.65	
BMI	Normal	1		
	Underweight	0.64	0.13 - 3.10	0.576
	Overweight/Obesity	3.61	1.38 - 9.46	0.009

IV. DISCUSSION

Our study results showed that the prevalence of osteoporosis according to BMD at the femoral neck of the DTNC was 5.8% and the prevalence of osteoporosis according to BMD in the lumbar spine was 4.0%. This result shows that the rate of osteoporosis in women aged 35 to 65 in our study was lower than that of author Vo Thi Thanh Hien and colleagues (2021). This group of authors recorded the rate of osteoporosis in women visiting Nghe An Provincial General Hospital as 54.31%, of which 8.33% had severe osteoporosis [4]. This difference may be because this group of authors' research was conducted on patients in the clinical. For hospital-acquired patients, who may have had symptoms related to osteoporosis but our study was conducted on community - dwelling women. In this study, we used BMD at the femoral neck to determine osteoporosis in women aged 35 - 65 and used this data to analyze factors related to osteoporosis among women. The reason is that in Vietnam, it is estimated that there are about 17,000 cases of femoral neck fractures in women and about 6,300 cases of femoral neck fractures in men each year and this number will continue to increase in the coming time. This shows that the number of femoral neck fractures in women is many times higher than in men and one of the risks of fracture is osteoporosis in this group [4]. Among our osteoporosis cases, 69.0% were in the age group of 55 - 65 and 6.9% were in the age group of 35 - 44. Previous studies on osteoporosis have shown that osteoporosis often begins in the premenopausal age and increases rapidly after menopause. However, new studies have also mentioned the issue of younger age at the onset of osteoporosis. This is less common but often occurs in the context of chronic disease, medications that affect bone metabolism, and other risk factors [5].

Our study showed that the women who did not meet the recommended physical activity were 2.68 times more likely to develop osteoporosis than those who met the recommended physical activity (OR = 2.68; 95% CI: 1.08 - 6.65, p = 0.033). This result is similar to the study of Vo Thi Thanh Hien et al., which found a relationship between a physically active lifestyle and osteoporosis in women [4]. Moderate physical activity is an effective non-pharmacological treatment that enhances bone formation and helps reduce osteoporosis. This may be because physical activity affects apoptosis and autophagy by releasing hormones and anti-inflammatory cytokines under mechanical stress. Mechanical stimulation promotes osteogenic differentiation of bone marrow mesenchymal stem cells, and it can also change the epigenetic status of osteogenic genes and show increased osteogenesis [5]. Research by author Nguyen Minh Phuong confirms that physical activity is a fundamental factor in improving BMD, increasing muscle strength, and reducing the risk of osteoporosis and fractures [6]. It is important to avoid exercises that can damage weakened bones. In patients over 40 years old and those with heart disease, obesity, diabetes, and hypertension, exercise should be prescribed and supervised by doctors. Vigorous exercise (such as marathon running) in young women for weight loss can promote osteoporosis [7].

Our results also showed that overweight/ obese women were 3.61 times more likely to have osteoporosis than the group of women with normal nutritional status (OR = 3.61; 95% CI: 1.38 - 9.46, p = 0.009). This result is similar to the results of the study by Yuan-Yuei C. (2018) in China, which showed a significant inverse association between body fat percentage and BMD, whereby the higher the body fat percentage, the lower the BMD [8]. The authors suggested that the first mechanism explaining osteoporosis in obesity is that high blood lipid concentrations have a direct effect on reducing BMD. In vitro studies have shown that oxidized lipids stimulate osteoclasts and inhibit osteoblasts in bone tissue, reducing BMD and causing osteoporosis. The second mechanism is that oxidized blood lipid molecules cause atherosclerosis, reducing blood flow to nourish bones, and reducing the supply of calcium and nutrients necessary for bone tissue building, leading to bone loss and osteoporosis. This result is similar to the author Neglia C. (2016) when analyzing the risk of osteoporosis

according to the level of obesity, also found that the risk of osteoporosis increased with the level of obesity [9].

However, some recent studies have shown that the age of "obesity" is gradually getting younger, usually from 45 to 50 years old and above, even from 35 years old and above. People aged 45 to 55 often reduce activities, have many changes in their biological cycle, have many diseases, and have a lot of stress due to living conditions. Estrogen hormones are no longer as good as when they were young, the lack of hormones directly affects the body's metabolism, causing more fat to accumulate and rapid weight gain. Due to the decrease in hormones, the ability to absorb nutrients is reduced, especially the absorption of vitamins and minerals, including Calcium. On the contrary, for younger people, the rate of overweight and obesity increases rapidly due to a sedentary lifestyle, little physical activity, eating habits, and food use

V. CONCLUSION

Osteoporosis remains a significant health concern among women aged 35 to 65, with a prevalence of 5.8% at the femoral neck and 4.0% at the lumbar spine. Our findings highlight the critical influence of physical activity and overweight-obesity on osteoporosis risk. Women with inadequate physical activity levels were found to be 2.68 times more likely to develop osteoporosis, while those classified as overweight or obese had a 3.61 times greater risk. These results underscore the importance of targeted public health interventions aimed at promoting physical activity and managing body weight to reduce osteoporosis risk. Increased community awareness, lifestyle modifications, and preventive healthcare measures are essential to addressing this growing issue. Future research should explore additional factors influencing bone health and evaluate the effectiveness of preventive strategies in different population groups.

Disclosure

The authors report no other conflicts of interest in this work.

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