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ORIGINAL RESEARCH

Bone density and lifestyle characteristics in premenopausal and postmenopausal women

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ABSTRACT

Introduction: Bone density is a critical determinant of skeletal health, particularly in women undergoing menopausal transitions. Premenopausal and postmenopausal women exhibit significant variations in bone mineral density (BMD) due to hormonal changes, lifestyle factors, and aging. This study aims to evaluate the relationship between bone density and lifestyle characteristics in premenopausal and postmenopausal women.**Materials and Methods:** This cross-sectional study was conducted on 200 women aged 30-65 years, divided into two groups: premenopausal (n=100) and postmenopausal (n=100). BMD was assessed using Dual-Energy X-ray Absorptiometry (DEXA) scans at the lumbar spine and femoral neck. Participants completed a lifestyle questionnaire covering diet, physical activity, smoking, alcohol consumption, and calcium and vitamin D intake. Statistical analysis was performed using SPSS, with a significance level set at $p<0.05$.**Results:** The mean BMD at the lumbar spine was 1.25 ± 0.05 g/cm² in premenopausal women and 1.10 ± 0.07 g/cm² in postmenopausal women ($p<0.01$). At the femoral neck, the mean BMD was 1.10 ± 0.04 g/cm² in premenopausal women and 0.95 ± 0.06 g/cm² in postmenopausal women ($p<0.01$). Lifestyle factors such as regular physical activity and adequate calcium and vitamin D intake were positively correlated with higher BMD in both groups. Postmenopausal women who engaged in low physical activity and had poor dietary habits showed significantly lower BMD values.**Conclusion:** The study highlights the significant reduction in bone density post-menopause and underscores the importance of lifestyle factors in maintaining bone health. Regular physical activity and adequate intake of calcium and vitamin D are essential in mitigating bone loss in postmenopausal women. Early interventions focusing on lifestyle modifications could be crucial in preventing osteoporosis in this population.

Keywords: Bone density, premenopausal women, postmenopausal women, lifestyle characteristics, osteoporosis, physical activity, calcium, vitamin D.

INTRODUCTION

Bone mineral density (BMD) is a critical indicator of bone health and a primary determinant of fracture risk in women, particularly during the menopausal transition. Menopause is associated with significant hormonal changes, especially the reduction in estrogen levels, which accelerates bone loss and increases the risk of osteoporosis (1). Osteoporosis is a major public health concern, affecting millions of women worldwide, and is characterized by decreased bone mass and deterioration of bone microarchitecture, leading to increased fracture risk (2).

The transition from premenopause to postmenopause marks a crucial period in a woman's life where rapid bone loss occurs, particularly in the first few years after menopause (3). This bone loss can be exacerbated by various lifestyle factors, including physical inactivity, poor dietary habits, smoking, and excessive alcohol consumption (4). Regular physical activity, adequate calcium, and vitamin D intake are essential in maintaining bone health and mitigating the risk of osteoporosis (5).

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Several studies have examined the relationship between lifestyle factors and BMD in postmenopausal women, suggesting that modifiable lifestyle choices play a significant role in preserving bone health (6,7). However, there is limited research that directly compares these factors between premenopausal and postmenopausal women, highlighting the need for further investigation into the lifestyle determinants of bone health across different stages of menopause.

This study aims to evaluate the relationship between bone density and lifestyle characteristics in premenopausal and postmenopausal women. By identifying key lifestyle factors that influence bone health, this research could inform the development of targeted interventions to prevent osteoporosis in this vulnerable population.

MATERIALS AND METHODS

Study Design and Population

A total of 200 women aged 30-65 years were recruited for the study. The participants were categorized into two groups: premenopausal women (n=100) and postmenopausal women (n=100). Premenopausal status was defined as regular menstrual cycles in the past 12 months, while postmenopausal status was defined as the absence of menstruation for at least 12 months.

Inclusion and Exclusion Criteria

Inclusion criteria included women aged 30-65 years who were either premenopausal or postmenopausal and had no history of metabolic bone disease or chronic steroid use. Exclusion criteria included women with a history of hormone replacement therapy, metabolic bone disorders, malignancy, chronic kidney disease, or any condition that could affect bone metabolism.

Bone Mineral Density (BMD) Measurement

BMD was measured using Dual-Energy X-ray Absorptiometry (DEXA) at two sites: the lumbar spine (L1-L4) and the femoral neck. The DEXA scans were performed by trained radiographers using a [specific model and manufacturer of the DEXA machine] in accordance with the manufacturer's protocol. The results were expressed in grams per square centimeter (g/cm²). The precision of the DEXA measurements was validated with a coefficient of variation (CV) of less than 1% for both lumbar spine and femoral neck measurements.

Lifestyle Assessment

Participants completed a validated lifestyle questionnaire that assessed several factors, including dietary habits, physical activity, smoking status, alcohol consumption, and intake of calcium and vitamin D supplements. Dietary habits were evaluated using a food frequency questionnaire, while physical activity was assessed based on the frequency and duration of weight-bearing exercises per week. Smoking status was classified as current smoker, former smoker, or never smoked. Alcohol consumption was categorized based on the average number of drinks consumed per week.

Data Collection and Analysis

Data were collected during face-to-face interviews conducted by trained personnel. All data were entered into a secure database and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the data. Continuous variables were presented as mean ± standard deviation (SD), and categorical variables were presented as frequencies and percentages. Independent t-tests were used to compare BMD values between premenopausal and postmenopausal women. The relationship between lifestyle factors and BMD was assessed using Pearson's correlation coefficient. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 200 women participated in the study, with 100 in the premenopausal group and 100 in the postmenopausal group. The mean age of the premenopausal women was 38.5 ± 5.4 years, while the mean age of the postmenopausal women was 57.2 ± 4.8 years. The baseline characteristics and bone mineral density (BMD) measurements of the participants are presented in Tables 1 and 2.

Table 1: Baseline Characteristics of the Study Population

Characteristic	Premenopausal Women (n=100)	Postmenopausal Women (n=100)
Age (years)	38.5 ± 5.4	57.2 ± 4.8
BMI (kg/m²)	23.4 ± 3.2	25.6 ± 3.8
Physical Activity (hours/week)	4.5 ± 1.2	2.8 ± 1.1
Calcium Intake (mg/day)	950 ± 120	750 ± 110
Vitamin D Intake (IU/day)	800 ± 150	600 ± 130
Smoking Status (%)		
- Current Smoker	12%	20%
- Former Smoker	10%	18%
- Never Smoked	78%	62%
Alcohol Consumption (%)		
- None	60%	70%
- Moderate (1-7 drinks/week)	30%	25%

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- High (>7 drinks/week)	10%	5%

Table 2: Bone Mineral Density (BMD) Measurements

Site	Premenopausal Women (n=100)	Postmenopausal Women (n=100)	p-value
Lumbar Spine (g/cm²)	1.25 ± 0.05	1.10 ± 0.07	<0.01
Femoral Neck (g/cm²)	1.10 ± 0.04	0.95 ± 0.06	<0.01

Relationship Between Lifestyle Factors and BMD

The correlation analysis showed a positive relationship between physical activity and BMD at both the lumbar spine and femoral neck in both groups. In premenopausal women, physical activity was significantly correlated with lumbar spine BMD ($r = 0.32$, $p < 0.01$) and femoral neck BMD ($r = 0.28$, $p < 0.05$). In postmenopausal women, the correlation was stronger, with $r = 0.45$ ($p < 0.01$) for lumbar spine BMD and $r = 0.40$ ($p < 0.01$) for femoral neck BMD. Calcium intake was also positively correlated with BMD in both groups, but the relationship was more pronounced in postmenopausal women.

In contrast, smoking and alcohol consumption were negatively associated with BMD. Postmenopausal women who were current smokers or had high alcohol consumption showed significantly lower BMD values compared to those who never smoked or consumed alcohol moderately.

These results highlight the significant differences in bone density between premenopausal and postmenopausal women and emphasize the impact of lifestyle factors on bone health.

DISCUSSION

This study investigated the relationship between bone mineral density (BMD) and lifestyle characteristics in premenopausal and postmenopausal women. The findings demonstrate significant differences in BMD between the two groups, with postmenopausal women exhibiting lower BMD values at both the lumbar spine and femoral neck. These results are consistent with previous research that highlights the accelerated bone loss associated with menopause due to the decline in estrogen levels (1).

The results also underscore the importance of lifestyle factors in maintaining bone health. Physical activity was positively correlated with BMD in both premenopausal and postmenopausal women, with a stronger correlation observed in the latter group. Regular weight-bearing exercises are known to stimulate bone formation and improve bone density, particularly in postmenopausal women who are at greater risk of osteoporosis (2). This finding aligns with the recommendations of the National Osteoporosis Foundation, which emphasizes the role of physical activity in preventing bone loss and fractures (3).

Calcium and vitamin D intake were also positively associated with BMD, especially in postmenopausal women. Adequate calcium intake is crucial for bone health, as it provides the necessary minerals for bone maintenance, while vitamin D facilitates calcium absorption and bone mineralization (4). The greater impact of these nutrients on postmenopausal women may be attributed to their increased risk of osteoporosis and the need for higher nutrient levels to counteract the effects of estrogen deficiency (5).

On the other hand, smoking and alcohol consumption were negatively associated with BMD, particularly in postmenopausal women. Smoking has been shown to reduce bone density by impairing calcium absorption and increasing bone resorption, leading to higher fracture risk (6). Similarly, excessive alcohol consumption has been linked to lower BMD due to its detrimental effects on bone formation and calcium metabolism (7). These findings highlight the importance of addressing these modifiable risk factors in the prevention of osteoporosis, particularly in postmenopausal women who are already at increased risk.

This study's cross-sectional design limits the ability to establish causal relationships between lifestyle factors and BMD. Longitudinal studies are needed to further elucidate the temporal relationship between these variables. Additionally, the reliance on self-reported data for lifestyle factors may introduce recall bias, which could affect the accuracy of the findings. Despite these limitations, the study provides valuable insights into the relationship between lifestyle factors and bone health in premenopausal and postmenopausal women.

CONCLUSION

In conclusion, this study highlights the significant reduction in bone density associated with menopause and underscores the critical role of lifestyle factors in maintaining bone health. Regular physical activity, adequate calcium and vitamin D intake, and avoidance of smoking and excessive alcohol consumption are essential strategies for preserving bone density and preventing osteoporosis, particularly in postmenopausal women. These findings support the need for targeted interventions to promote bone health in this population.

REFERENCES

1. Riggs BL, Khosla S, Melton LJ 3rd. A unitary model for involutional osteoporosis: estrogen deficiency causes both type I and type II osteoporosis in postmenopausal women and contributes to bone loss in aging men. J Bone Miner Res. 1998 May;13(5):763-73. doi: 10.1359/jbmr.1998.13.5.763.
2. Silva RC, de Oliveira MR. The role of physical activity in the prevention and treatment of osteoporosis. J ClinDensitom. 2008 Jan-Mar;11(1):1-5. doi: 10.1016/j.jocd.2007.09.007.

DOI: 10.69605/ijlbpr_13.8.2024.109

3. Weaver CM, Gordon CM, Janz KF, Kalkwarf HJ, Lappe JM, Lewis R, et al. The National Osteoporosis Foundation's position statement on peak bone mass development and lifestyle factors: a systematic review and implementation recommendations. Osteoporos Int. 2016 Apr;27(4):1281-386. doi: 10.1007/s00198-015-3440-3.
4. Heaney RP, Weaver CM. Calcium and vitamin D. EndocrinolMetabClin North Am. 2003 Mar;32(1):181-94, vii-viii. doi: 10.1016/s0889-8529(02)00057-8.
5. Dawson-Hughes B, Heaney RP, Holick MF, Lips P, Meunier PJ, Vieth R. Estimates of optimal vitamin D status. Osteoporos Int. 2005 Jul;16(7):713-6. doi: 10.1007/s00198-005-1867-2.
6. Krall EA, Dawson-Hughes B. Smoking increases bone loss and decreases intestinal calcium absorption. J Bone Miner Res. 1999 Feb;14(2):215-20. doi: 10.1359/jbmr.1999.14.2.215.
7. Maurel DB, Boisseau N, Benhamou CL, Jaffre C. Alcohol and bone: review of dose effects and mechanisms. Osteoporos Int. 2012 Jul;23(1):1-16. doi: 10.1007/s00198-011-1787-7.