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Original Article

Unveiling the Burden of Osteoporosis: Exploring the Prevalence and Risk Factors among Postmenopausal Women in North Central Bangladesh.

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Abstract

Background: *Osteoporosis affects 30% of women globally between the ages of 40 and 50. This disease is among the top causes of death and disability among the elderly. This study aimed to examine the prevalence of primary osteoporosis and poor bone density in postmenopausal women, as well as their sociodemographic, obstetric and lifestyle risk factors.* ***Aim:*** *The purpose of this study is to investigate at the prevalence of osteoporosis and the risk factors linked with it in postmenopausal women.* ***Methods:*** *The present prospective cross-sectional study was conducted on postmenopausal women who visited orthopedics, gynecology and medicine out patient departments between August 2022 and March 2023; 539 women aged 45 to 80 years with verified menopause were recruited. The final recommendation was for 539 women to have bone mineral density testing utilizing dual energy X-ray absorptiometry. Socio-individual, obstetric-medical, short-form physical activity, and anthropometric questionnaires were administered. Chi-square and Student's t-tests were applied to categorical and continuous data, respectively, to assess the differences between the groups. In SPSS 26, P<0.05 was regarded to indicate significant connections.* ***Results:*** *In our study, 38.0% of participants were between 56 and 60 years of age. The majority of the individuals (51.9%) were illiterate. 37.7% of respondents reported having six or more children. 3.6% of the sample smoked or chewed tobacco. 61.0 percent of individuals had menopause after the age of 45, and 48.8% of subjects had experienced menopause for more than ten years at the time of enrollment in the research. 83.5% of postmenopausal women were affected by osteoporotic fractures (osteoporosis: 40.0% and osteopenia: 43.5%). The incidence of osteoporosis rose as parity and abortion rates increased. The prevalence of osteoporosis was greater (P< 0.05) among those with a familial history of osteoporosis-related symptoms and fragility fracture, as well as a personal history of fragility fracture.* ***Conclusion:*** *Given the significant prevalence of primary osteoporosis and poor bone density in postmenopausal women, health education is essential for minimizing modifiable risk factors and mitigating the disease's consequences.*

Keywords: *Bone mineral density, fracture, osteoporosis, postmenopausal, Bangladesh*

Introduction: Osteoporosis is the most common bone metabolic illness and a severe threat to human health, ranking fourth among the primary causes of morbidity and death, after cancer, cardiovascular disease, and stroke. Its occurrence increases with increasing age, which contributes to its relevance[1,2]. Osteoporosis is characterized by decreased bone mass and structural degradation, which increases bone fragility and fracture susceptibility[1,2]. Due to its close correlation with fractures, osteoporosis is a major health problem in all nations. T-score and Z-score in dices are applied to assess bone density. The World Health Organization (WHO) defines osteoporosis as bone mineral density (BMD) that is at least 2.5 standard deviations (SDs) below the mean maximum BMD[3,4]. The T-score reflects deviations in an individual's bone density relative to that of healthy and young individuals, while the Z-score signifies deviations in bone density

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compared to individuals of similar age, sex, and race. Consequently, osteoporosis is defined as a T-score < −2.5, whereas a T-score between −1 and −2.5 indicates osteopenia. Factors such as age, sex, race, genetics, low calcium intake, and physical activity exert influences on bone mass[5].

Two types of osteoporosis are recognized. Osteoporosis of type I is caused by estrogen deficiency in postmenopausal women. Age is the cause of osteoporosis type II At least 20% of instances of osteoporosis are secondary, resulting from diseases, deficits or drugs, primarily glucocorticoids[6,7]. After menopause, bone mineral density declines by around 5% every year. Following that, it falls to 1–1.5 percent [8].

Estimates of the global prevalence of osteoporosis range from 4 to 40 % [9]. More than 200 million people worldwide suffer from osteoporosis, with forecasts indicating a shocking 240% increase in the number of afflicted women by 2050[10,11]. Each year, postmenopausal women lose 3–5% of their bone mass, which contributes to osteoporosis. Osteoporosis is caused by estrogen insufficiency brought on by menopause. Menopausal osteoporosis is significant because women spend the majority of their lives with decreased bone density and greater fracture risk, especially in the years immediately after menopause [12,13]. Bone loss during menopause follows a two-phase pattern. In the near term (3–5 years), there is a fast loss of trabecular bone (menopause-related bone loss). Long-term (over 10–20 years), both men and women's cortical and trabecular bones eventually degrade (age-related bone loss)[14]. The clinical manifestations of osteoporosis primarily encompass fractures, chronic pain, and disability. Pelvic, vertebral, and distal radius fractures are the most commonly observed osteoporotic fractures. Notably, these fractures not only lead to morbidity but also elevate the risk of mortality, with a 20% mortality rate within the first year following a hip fracture [15,16].

Numerous factors contribute to the development of osteoporosis, including lifestyle choices, drug usage, various diseases, dietary patterns, etc. [17,18], as well as other risk factors such as female gender, decreased sex hormone levels, advanced age, early menopause (before 45 years), low body mass index, sedentary lifestyle, positive family history, prior history of bone fractures, stress, lactation, alcohol consumption, and smoking [19,20]. Moreover, studies indicate that females with five or more children have lower bone mineral density [21].

Previous studies have reported a high prevalence of osteoporosis among women living in the community of Bangladesh, emphasizing the considerable physical and economic burdens imposed by osteoporosis and osteopenia on individuals and society within the country [22]. Given the substantial burden of osteopenia/osteoporosis in Bangladeshi women, it is imperative to implement appropriate intervention strategies aimed at minimizing future fractures and reducing the associated social and economic impact on society [23].

Gazipur, located in the central part of Bangladesh, represents a densely populated province. However, comprehensive studies examining the prevalence of primary osteoporosis and its risk factors within this specific region remain scarce. Considering the growing elderly population and the elevated rates of osteoporosis, particularly among women following menopause, it is crucial to prioritize screening programs for postmenopausal osteoporosis and develop preventive measures targeting modifiable risk factors in this region. Therefore, the present study aims to investigate the prevalence of osteoporosis and associated risk factors among postmenopausal women in the north-central region of Bangladesh.

Materials and Methods

This prospective cross-sectional study focused on postmenopausal women who visited orthopedics, gynecology-obstetrics, and medicine outpatient departments between August 2022 and March 2023. A total of 539 women between the ages of 45 and 80 who had proven menopause (one or more years without menstruation) were recruited for the research. Exclusion criteria included the presence of bone diseases other than osteoporosis (confirmed by an endocrinologist), rheumatoid arthritis, metastatic bone disease, use of medications affecting bone metabolism (such as intravenous bisphosphonate use within the past 5 years or oral bisphosphonate use within the last 6 months), cumulative oral bisphosphonate use for more than 3 years or at least 1

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month within 6-12 months prior to the study, and use of parathyroid hormone Participants who satisfied the inclusion criteria and showed a desire to participate were instructed to report to the health facility at a specific time. During the conference, the study's objectives were reaffirmed and exclusion criteria were evaluated. Those who remained eligible gave informed consent and were supplied with questionnaires.

Subsequently, the 539 women underwent bone mineral density (BMD) testing. When available, they were referred to another healthcare department for dual-energy X-ray absorptiometry (DEXA), where measurements of BMD at the lumbar spine and femoral neck were performed. All DEXA measurements were conducted by a trained and experienced radiology technician. The subjects were categorized based on T-scores, calculated according to the World Health Organization (WHO) guidelines[24], into women with osteoporosis (n = 215), women with osteopenia (n = 235), and women with normal bone mass (n = 89). All postmenopausal women provided written consent prior to participating in the study.

BMD measurements of the women in a supine position were obtained using a DXA machine (NORLAND, XR-46TM, Cooper Surgical Company, Trumbull, CT, USA). The primary outcomes were BMD at the lumbar spine and femoral neck. Following the WHO guidelines[24], women were classified as osteoporotic if their T-score was ≤2.5 standard deviations (SD), osteopenic if the T-score fell between -1 and -2.5 SD, and normal (without bone loss) if the T-score was <1 SD from the optimal peak bone density observed in healthy young adults of the same sex. The DXA system was calibrated daily using manufacturer-provided Phantoms, and the coefficient of variation for BMD measurements at the hip and spine was determined to be <4%.

A structured pro forma was utilized to collect demographic and maternal characteristics (age group, education, marital status, history of abortion, breast feeding, and smoking/tobacco intake), menstrual characteristics (age at menarche, years of menstruation, age at menopause, and duration of menopause), self and family history related to osteoporosis (family history of osteoporosis-related symptoms, family history of fragility fractures, and personal history of fragility fractures), and clinical and laboratory profiles (body mass index [BMI], physical activity, immobilization, presence of diabetes and hypertension, calcium intake, statin use, Vitamin D3 supplementation, and Vitamin D3 levels).

BMI was calculated by dividing weight in kilograms by the square of height in meters. A sedentary or active lifestyle was defined by whether or not the participant engaged in at least 30 minutes of daily brisk walking or aerobic activity. The systolic and diastolic blood pressures were measured as the average of three sphygmo manometer readings recorded with a 3-minute gap between each reading with the individual in a relaxed position. Immobilization was defined as being confined to bed for more than two months continuously. Using radioimmunoassay, serum vitamin D3 concentrations were evaluated and categorized as follows: Vitamin D deficiency (>20 ng/mL), Vitamin D insufficiency (20-29 ng/mL), and Vitamin D sufficiency (≥30 ng/mL). The Institutional Ethical Review Committee of City Medical College, Gazipur, Bangladesh, approved the study protocol.

Statistical analysis

After data collection, SPSS/Ver 26 (IBM SPSS Statistics, IBM Corporation, Chicago, IL) and Microsoft Excel were used to analyze the data. Utilizing descriptive data such as frequency and percentage, the prevalence of primary osteoporosis and poor bone density was determined. The data is presented as a number, a percentage, or the mean standard deviation. For categorical and continuous variables, respectively, the Chi-square test and Student's t-test were employed to determine the differences between the groups. $P < 0.05$ was deemed to indicate statistically significant connections.

Result:

In our study, we observed that 36.0% of the participants fell within the 45-55 years age group. The 56-60 years age group accounted for 38.0% of the subject population, while those above 60 years old constituted 25.0%. Approximately half of the subjects (51.9%) had no formal education. The majority of participants (90.4%) were married, and 37.7% had given birth to six or more children.

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A small proportion of subjects (11.3%) had a history of more than two abortions. Among the participants, 81.5% reported a history of breastfeeding. A minority (3.6%) of subjects were currently engaged in smoking or using tobacco products [Table:1].

Table 1. Sociodemographic characteristics of postmenopausal women (n= 539)

Variables	*n* (%)
Age group (years)	
45-55	195 (36.0)
56-60	210 (38.0)
>60	134 (25.0)
Education	
Illiterate	280 (51.9)
Primary school/middle school	148 (27.5)
High school or above	111 (20.6)
Marital status	
Single	9(1.7)
Married	487 (90.4)
Divorced or widowed	43 (8.0)
Parity	
2 or less children	104 (19.3)
3-4 children	232 (43.0)
5 or more children	203 (37.7)
Abortion	
Nil	369 (68.5)
1-2	109 (20.2)
>2	61 (11.3)
Ever breast feed	
Yes	439 (81.5)
No	100 (18.5)
Smoking/tobacco intake	
Never smoke/chewed tobacco	520 (96.4)
Current smoker/tobacco chewer	19 (3.6)

The study subjects had a mean age at menarche of 13.17 ± 1.85 years. The average duration of menstruation was 37.21 ± 3.76 years. Among the subjects, 39.0% experienced menopause after the age of 50, while 48.8% had a duration of menopause exceeding 10 years at the time of enrollment in the study. [Table:2].

Table 2. Menstrual characteristics of postmenopausal women (n=539)

Variables	*n* (%)
Age at menarche (years), mean ±SD	13.17±1.85
Years of menstruation (years), mean ±SD	37.21±3.76
Age at menopause (years)	
≤45	330 (61.0)
>50	209 (39.0)
Duration of menopause (years)	
≤5	142 (26.3)
6-10	134 (24.9)
>10	263 (48.8)

A significant proportion of the subjects (59.0%) had a body mass index (BMI) that fell within the obese category. The use of statins was reported by 67.9% of the subjects. Among the participants, 42.0% had a diagnosis of diabetes, while 60.0% had hypertension. A family history of symptoms related to osteoporosis was reported by 50.0% of the subjects, and 43.0% reported a family history of fragility fractures. [Table:3].

Table 3. Clinical characteristics and family history of the postmenopausal women (n=539)

Variables	*n* (%)
BMI (kg/m^2)	
Normal	76 (14.0)
Overweight	143 (27.0)
Obese	320 (59.0)
Physical activity	
Yes	65 (12.0)
No	474 (88.0)
Immobilization	
Yes	27 (5.0)
No	512 (95.0)
Diabetic	
Yes	225 (42.0)
No	314 (58.0)
Hypertensive	
Yes	325 (60.0)
No	214 (40.0)
Calcium intake (mg/day)	
<600	238 (44.2)
600-1000	166 (30.8)
>1000	135 (25.0)
Use of statin	
Yes	366 (67.9)
No	173 (32.1)
Use of Vitamin D3	
Yes	58 (10.8)
No	481 (89.2)

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Vitamin D3 level (ng/mL)	
Normal	285 (53.0)
Insufficiency	140 (26.0)
Deficiency	114 (21.0)
Family history of symptoms related to osteoporosis	
Yes	270 (50.0)
No	269 (50.0)

The frequency of primary osteoporosis and low bone density among postmenopausal women was found to be higher in the lumbar spine compared to the femoral neck, based on the T-score index. Specifically, 165 (31.1%) women had primary osteoporosis in the lumbar vertebrae, while 65 (12.0%) women had primary osteoporosis in the femoral neck. The prevalence of osteopenia, indicating reduced bone density, was 233 (43%) based on the lumbar spine T-score and 312 (59.0%) based on the femoral neck T-score. Overall, out of the 539 women included in the study, 215 (40.0%) had primary osteoporosis, 235 (43.5%) had osteopenia and 89 (16.5%) were classified as having normal bone mass. [Table:4].

Table 4. Prevalence of osteoporosis and osteopenia among postmenopausal women (n=539)

Prevalence	Lumbar spine, *n* (%)	Left femoral neck, *n* (%)	Overall, *n* (%)
Osteoporosis	165 (31.0)	65 (12.0)	215 (40.0)
Osteopenia	233 (43.0)	312 (59.0)	235 (43.5)
Normal	141 (26.0)	160 (29.0)	89 (16.5)

Dual-energy X-ray absorptiometry (DXA) conducted at the femoral neck (hip) and lumbar region (L1–L4 vertebrae) revealed that 215 (40.0%) of the subjects had osteoporosis, indicating a significant decrease in bone mineral density (BMD). Osteopenia, which signifies a lower level of bone density but not as severe as osteoporosis, was observed in 235 (43.5%) of the subjects. Only 89 (16.5%) of the subjects had a normal BMD, indicating no significant decrease in bone density. (fig:1)

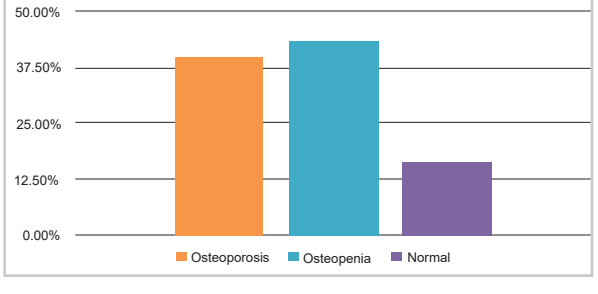

Fig.1: Prevalence of osteoporosis, osteopenia and normal bone density among postmenopausal women

Table 5 demonstrates that there is a significant association between certain factors and the prevalence of osteoporosis. Subjects with a higher age at menarche (13.98 ± 1.78) and a shorter duration of menstruation (36.02 ± 3.92) were more likely to have a higher prevalence of osteoporosis ($P < 0.05$). Similarly, subjects with a longer duration of menopause showed a higher prevalence of osteoporosis ($P < 0.05$). Additionally, subjects who had a family history of symptoms related to osteoporosis or fragility fractures, as well as those with a self-history of fragility fractures, exhibited a higher prevalence of osteoporosis ($P < 0.05$).

Table 5. Association of prevalence of osteoporosis with the various characteristics of the study subjects (n=539)

Variables	Osteoporosis (*n*=215), *n* (%)	Osteopenia (*n*=235), *n* (%)	Normal (*n*=89), *n* (%)	*p*
Age group (years)				
45-55 (*n*=195)	65 (33.0)	85 (44.0)	45 (23.0)	<0.0001
56-60 (*n*=210)	80 (38.1)	110 (52.3)	20 (9.6)	
>60 (n=134)	70 (52.0)	40 (30.0)	24 (18.0)	
Education				
Illiterate (*n*=280)	119 (43.0)	141 (50.0)	20 (7.0)	0.015
Primary school/middle school (*n*=148)	40 (27.0)	80 (54.0)	28 (19.0)	
High school or above (*n*=111)	56 (50.0)	14 (13.0)	41 (37.0)	
Marital status				
Married (*n*=487)	170 (35.0)	230(47.0)	87 (18.0)	0.010
Divorced or widowed or single (*n*=52)	45 (87.0))	5 (10.0)	2 (3.0)	
Parity				
2 or less children (*n*=104)	25 (24.0)	35 (34.0)	44 (42.0)	0.201
3-5 children (*n*=232)	50 (22.0)	160 (69.0)	22 (9.0)	
6 or more children (*n*=203)	140 (69.0)	40 (20.0)	23 (11.0)	
Abortion				
Nil (*n*=369)	160 (43.0)	160 (43.0)	49 (14.0)	0.699
1-2 (*n*=109)	40 (37.0)	55 (50.0)	14 (13.0)	
>2 (*n*=61)	15 (24.0)	20 (33.0)	26 (43.0)	
Ever breast feed				
Yes (*n*=439)	180 (41.0)	200 (46.0)	59 (13.0)	0.377
No (*n*=100)	35 (35.0)	35 (35.0)	30 (30.0)	
Smoking/tobacco intake				
Never smoke/chewed tobacco (*n*=520)	200 (38.0)	233 (45.0)	87 (17.0)	0.654
Current smoker/tobacco chewer (*n*=19)	15 (78.0)	2 (11.0)	2 (11.0)	
Age at menarche (years)*, mean ±SD	13.98±1.78	13.23±1.43	13.48±1.33	<0.0001
Years of menstruation (years)*, mean ±SD	36.02±3.92	37.59±3.76	39.59±3.76	<0.0001

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Age at menopause (years)				
≤45 (*n*=330)	70 (21.0)	190 (58.0)	70 (21.0)	0.482
>50 (*n*=209)	145 (69.0)	45(22.0)	19 (9.0)	
Duration of menopause (years)				
≤5 (*n*=142)	26 (18.0)	70 (50.0)	46 (32.0)	0.001
6-10 (*n*=134)	61 (46.0)	50 (37.0)	23 (17.0)	
10 (*n*=263)	128 (49.0)	115 (44.0)	20 (7.0)	
BMI (kg/m^2)				
Normal (*n*=76)	15 (20.0)	35 (46.0)	26 (34.0)	0.344
Overweight (*n*=143)	65 (45.0)	55 (39.0)	23 (16.0)	
Obese (*n*=320)	135 (42.0)	145 (45.0)	40 (13.0)	
Physical activity				
Yes (*n*=65)	15 (23.0)	35 (54.0)	15 (23.0)	0.077
No (*n*=474)	200 (42.0)	200 (42.0)	74 (16.0)	
Immobilization				
Yes (*n*=27)	2 (7.0)	5 (19.0)	20 (74.0)	0.719
No (*n*=512)	213 (42.0)	230(45.0)	69 (13.0)	
Diabetic				
Yes (*n*=225)	140 (62.0)	65 (29.0)	20 (9.0)	<0.0001
No (*n*=314)	75 (24.0)	170 (54.0)	69 (22.0)	
Hypertensive				
Yes (*n*=325)	145 (45.0)	135 (42.0)	45 (13.0)	0.951
No (*n*=214)	70 (33.0)	100 (47.0)	44 (20.0)	
Calcium intake (mg/day)				
<600 (*n*=238)	120 (50.0)	90 (38.0)	28 (12.0)	0.096
600-1000 (*n*=166)	65 (39.0)	70 (42.0)	31 (19.0)	
>1000 (*n*=135)	30(22.5)	75 (55.0)	30 (22.5)	
Use of statin				
Yes (*n*=366)	165 (45.0)	160 (44.0)	41 (11.0)	0.427
No (*n*=173)	50 (29.0)	75 (43.0)	48 (28.0)	
Use of Vitamin D3				
Yes (*n*=58)	15 (26.0)	25 (43.0)	18 (31.0)	0.515
No (*n*=481)	200 (41.0)	210 (43.0)	71 (16.0)	
Vitamin D3 level (ng/mL)				
Normal (*n*=285)	70 (24.0)	150 (53.0)	65 (23.0)	0.510
Insufficiency (*n*=140)	90 (64.0)	40 (29.0)	10 (7.0)	
Deficiency (*n*=114)	56 (48.0)	45 (39.0)	14 (12.0)	
Family history of symptoms related to osteoporosis				
Yes (*n*=270)	140 (52.0)	90 (33.0)	40 (15.0)	0.510
No (*n*=269)	75 (28.0)	145 (54.0)	49 (18.0)	
Family history of fragility fracture				
Yes (*n*=231)	115 (50.0)	75 (32.0)	41(18.0)	0.003
No (*n*=308)	100 (32.0)	160 (52.0)	48 (16.0)	
Self-history of fragility fracture				
Yes (*n*=202)	100 (49.0)	90 (45.0)	12 (6.0)	0.026
No (*n*=337)	115 (34.0)	145 (43.0)	77 (23.0)	

*Student's t-test analysis. BMI: Body mass index, SD: Standard deviation

Discussion:

Using the lumbar spine and the left femoral neck as reference locations, the prevalence of primary osteoporosis was determined. The rate of primary osteoporosis was found to be 31% in the lumbar region, 12% in the femoral neck region, and 40% overall, according to the findings of this study. Among our study, postmenopausal women displayed a significantly high prevalence of osteoporosis, indicating a substantial health problem in low socioeconomic groups. In addition, 37% of participants had a history of fragility fractures.

In a research done in Northern India, 37.5 % of postmenopausal women were found to have osteoporosis, whereas 18.9 % had a history of fragility fractures[25]. Another study compared osteoporosis prevalence in different countries, revealing rates of 15% in France and Germany, 16% in the United States, and 38% in Japan. For men, the prevalence rates were 1% in the United Kingdom, 4% in Japan, 3% in Canada, and 8% in France[26]. Based on T scores from the lumbar spine or femoral neck, a separate study done in Bangladesh discovered that among women aged 16 to 45, 43.6% had osteopenia and 5.5% had osteoporosis. In women aged 46 to 65, the prevalence rates for osteopenia and osteoporosis were 40.7% and 41.8%, respectively[22].

Comparing these studies with our findings suggests that the prevalence of osteoporosis in Bangladesh is substantially greater than in other countries. Moreover, our study revealed a prevalence of Vitamin D insufficiency of 21%, which is much higher than in nations where Vitamin D-enriched food is more prevalent (1.6% to 14.8% prevalence)[27]. In Asia, particularly India, Lebanon, Turkey, and China, has a higher prevalence of vitamin D insufficiency[28,29]. Many Bangladeshis, especially those living in densely populated cities, have limited access to Vitamin D from sun exposure. In addition, inexpensive food sources of vitamin D are uncommon, especially among those with a low socioeconomic position.

Numerous published researches have shown BMI as one of the most influential predictors of bone health. Bangladeshi women, especially those with a lower socioeconomic standing, have a much lower BMI

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than women in wealthy nations[22]. Numerous variables contribute to the onset of osteoporosis, which has been thoroughly investigated. Increasing age, particularly during the postmenopausal era, a low level of education, frequent pregnancies, a low socioeconomic situation, a low level of education, and a bad diet are all related with a higher frequency of osteoporosis[30].

Age, menopausal age, BMI, education level, and physical activity status were found as important risk factors for osteoporosis in postmenopausal women based on the findings of our study. In women aged 56 to 60, the probability of having osteoporosis increased by 52.2%. A literature study reveals that bone density declines with age, hence increasing the risk of fractures. The risk of fracture doubles for every 10% loss in bone mineral density (BMD)[31]. Low bone mass and weakened bone tissues are linked to increased bone fragility and fracture risk[32]. As individuals age, their bone mass decreases and the bones become porous, leading to an elevated risk of fractures. One contributing factor is the imbalance between new bone formation and old bone resorption, resulting in bone loss and compromised structural quality. Additionally, the decline in sex hormones has a significant impact on reducing bone density[33]. Marital status and menopausal age have shown a significant relationship with the prevalence of osteoporosis, potentially due to the effects of estrogen on menopausal age, aligning with our study's findings.

The main strength of our study is that we determined the prevalence and risk factors of primary osteoporosis during the early and late postmenopausal period. Additionally, a significant number of women from various age groups underwent bone scans, contributing to the robustness of our findings. However, our study has several limitations. Firstly, we were unable to exclude potential unknown medical conditions that may have affected bone mineral density, such as abnormal serum levels of vitamin D, parathyroid or thyroid hormone, or liver function. Secondly, the use of a single healthcare center may limit the generalizability of our findings. Finally, self-reported responses used as indicators of osteopenia and osteoporosis prevalence may be prone to recall bias. Consequently, estimates based on these women may not fully reflect the actual burden of osteopenia and osteoporosis in the population. These limitations may impact the overall generalizability of our findings.

For future studies, it is recommended to compare the demographics and lifestyles of the participants with those who were not included to enhance comparability. Additionally, the intake of calcium and Vitamin D supplements, as well as exposure to direct sunlight, were evaluated and compared in this study, but the investigation of food intake containing these substances was not conducted. Therefore, it is suggested that this aspect be evaluated in future studies.

Conclusion:

Our findings strongly advocate for the implementation of intervention programs aimed at screening and preventing osteopenia and osteoporosis among women in their reproductive and middle-age years. The ultimate goal is to alleviate the burden of hip and spinal fractures in this population over the long term. With the aging population in Bangladesh on the rise and the higher prevalence of osteoporosis observed in northern cities like Gazipur, it is evident that this issue will continue to escalate. Consequently, it is crucial to identify the predictive risk factors for osteoporosis, address and modify modifiable factors, and prioritize individuals with irreversible risk factors. By doing so, we can effectively prevent or reduce the impact of this epidemic.

Declarations

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on request.

Ethical Approval

The ethical permission received from the ethics review committee of City Medical College, Gazipur, Bangladesh. Prior to data collection, patients were told about the project consented, and anonymity was maintained throughout the study by removing their names and other personal identifiers. Confidentiality was strictly maintained during data processing and report writing.

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Consent to participate
All procedures performed in this study followed the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all the enrolled patients.

Consent for Publication: Not applicable

Code Availability: Not applicable

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