Section: General Medicine

Original Research Article

A STUDY OF PREVALENCE OF OSTEOPOROSIS IN INDIAN URBAN MALE ATTENDING PREVENTIVE SCREENING PROGRAM

Ganji Bhaskar[1], Monica Mahajan[2], Bharat Aggarwal[3], Aman Vij[4], Sujeet Jha[5]

[1]*Assistant Professor, Department of General Medicine, Govt Medical College and Hospital, Wanaparthy, Telangana, India.*
[2]*Principal Director and HOD, Department of Internal Medicine, Max Super Speciality Hospital, Saket, New Delhi, India.*
[3]*Principal Director, Department of Radiology, Max Super Speciality Hospital, Saket, New Delhi, India.*
[4]*Director, Department of Internal Medicine, Max Super Speciality Hospital, Saket, New Delhi, India.*
[5]*Principal Director, Department of Endocrinology, Max Super Speciality Hospital, Saket, New Delhi, India.*

Received *: 11/07/2026*
Received in revised form *: 09/08/2026*
Accepted *: 22/08/2026*

Corresponding Author:
Dr. Ganji Bhaskar,
Assistant Professor, Department of General Medicine, Govt Medical College and Hospital, Wanaparthy, Telangana, India.
Email: bhaskarganji9@gmail.com

DOI: 10.70034/ijmedph.2026.3.698

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (3); 4530-4535

ABSTRACT

Background: Osteoporosis is a major health problem that is often underrecognized in men. Impairment of bone mineral density may be caused by advancing age, including lifestyle and clinical factors. This study was conducted to estimate the prevalence of osteoporosis and osteopenia in the adult male population attending a preventive screening programme in a tertiary care teaching hospital in India.

Materials and Methods: This was a prospective observational study carried out in a tertiary care hospital. From a preventive health screening programme, 1230 men were recruited who met the inclusion criteria. Demographic, lifestyle factors, clinical history, relevant drug use, and laboratory parameters were evaluated. Bone health was assessed by measuring the bone mineral density, and the subjects were classified as normal bone health, osteopenia, and osteoporosis. The relationship of bone health status with selected demographic and clinical variables was statistically evaluated.

Results: The mean age of the cohort was 55.89 ± 10.34 years. Overall, 507 (41.2%) had normal bone health, 565 (45.9%) had osteopenia, and 158 (12.8%) had osteoporosis. The highest prevalence of site-specific osteoporosis was seen in the lumbar spine (L1–L4; 88 (7.2%)), left femoral neck (6.3%), left total femur (2.8%), and right femoral neck (2.3%). There was a significant increase in the prevalence of osteoporosis as age went up ($p<0.001$). Bone health was also significantly correlated with BMI ($p<0.001$), and there was a higher prevalence of osteoporosis in those patients with BMI <18.5 kg/m2. There was a significant association with steroid use and osteoporosis ($p=0.002$).

Conclusion: A significant number of adult men (12.8%) with osteoporosis and 45.9% with osteopenia had poor bone health. Older age, low BMI, and steroid use were significantly related to osteoporosis. These findings highlight the importance of recognizing osteoporosis as a clinically relevant condition in men and identifying individuals at increased risk through appropriate screening and risk-factor assessment.

Keywords: Osteoporosis, Osteopenia, Bone mineral density, Men, Vitamin D.

INTRODUCTION

Osteoporosis is a major skeletal disease marked by decreased bone strength and increased susceptibility to fractures. Although osteoporosis is traditionally considered a disease of women, it has become an important and growing health concern in men. Older age is a significant risk factor for osteoporosis, and men are at high risk of morbidity and mortality after osteoporotic fractures. Despite this, osteoporosis in men is often overlooked, undiagnosed, and untreated.[1,2] According to the World Health Organization (WHO), osteoporosis is a systemic skeletal disease that involves reduced bone mass and microarchitectural deterioration of bone tissue with

increased bone fragility and susceptibility to fracture.[3] The most widely used method for diagnosis of osteoporosis is bone mineral density (BMD), usually measured by dual-energy X-ray absorptiometry (DXA). A T score of ≤-2.5 or lower at the lumbar spine, total hip, or femoral neck is typically considered to be the diagnostic criterion for osteoporosis in postmenopausal women and men 50 years of age or older. Importantly, the presence of a fragility fracture can make the clinical diagnosis of osteoporosis in the absence of a densitometric diagnosis.[3,4] Osteoporosis is estimated to be present in approximately 1-2 million men in the United States, and about 8-13 million more men have low bone mass.[2] The risk is significantly higher in older individuals, especially if over 50 years of age, and is related to several factors such as low gonadal function, poor calcium and vitamin D nutrition, physical inactivity, smoking, excessive alcohol consumption, some drugs, and chronic systemic diseases. Osteoporosis is particularly relevant in India, where the population is ageing, and several nutritional and lifestyle factors may adversely affect skeletal health. In the 2009 International Osteoporosis Foundation (IOF) Asian Audit, expert groups estimated that the number of osteoporosis patients in India was approximately 26 million in 2003, with projections indicating that this would rise to 36 million patients by 2013.[5] It is expected that 50 million people in India are either osteoporotic (T-score lower than -2.5) or have low bone mass (T-score between -1.0 and -2.5).[6,7] Although much of the available Indian literature has focused on postmenopausal women, osteoporosis in men represents an important and relatively less investigated component of the overall disease burden. Vitamin D deficiency is another important concern in the Indian population. Despite abundant sunlight, vitamin D deficiency is widely reported, particularly among urban populations, with estimates suggesting a high prevalence of vitamin D insufficiency or deficiency.[8] In addition, hip fractures in Indian populations have been reported to occur approximately a decade earlier than those observed in Western populations.[9] These factors, together with increasing life expectancy and changing lifestyles, may contribute to a substantial future burden of osteoporosis and fragility fractures among Indian men. Osteoporotic fractures can result in prolonged disability, loss of independence, reduced quality of life, and increased mortality. Nevertheless, the absence of routine screening and the perception that osteoporosis is predominantly a female disorder may result in missed opportunities for early identification and intervention in men. Assessment of BMD and identification of individuals with osteoporosis or low bone mass can facilitate appropriate preventive and therapeutic measures before the occurrence of a major fragility fracture. Therefore, the present study was undertaken to assess osteoporosis among adult Indian males attending a preventive screening programme in a tertiary care teaching hospital.

MATERIALS AND METHODS

This prospective observational study was conducted on patients who attended the preventive health care program and underwent DEXA scan at Max Super Specialty Hospital, Saket, New Delhi. Institutional ethical approval was obtained for the study. Written informed consent was obtained from all the participants of the study after explaining the nature of the study in vernacular language.

Inclusion criteria

1. Aged 40 years and above
2. Presenting to preventive health care program
3. Males who underwent bone densitometry (DEXA) test
4. Voluntarily willing to participate in the study
5. Signing the informed consent

Exclusion Criteria

1. Non local residents
2. On treatment with vitamin D supplements and calcium
3. Intake of bisphosphonates or teriparatide
4. Those with a history of hip fractures

Sample Size: According to previous studies, the prevalence of osteoporosis in India is approximately 15%. Using this as a projected estimate and an error of 2% on either side, the sample size comes to 1224 with 95 % confidence; we propose to cover this many male subjects in our study.

Data Collection Methods: Patients who fulfill the inclusion criteria were enrolled and the collected data after informed consent for all subject's which are as follows Registration No, Demographic details (Age, Sex, height, weight, BMI), Past Medical history (Asthma, Thyroid disease, immunosuppressive drugs, anti-convulsant), Personal history (cigarette smoking), Initial lab investigatory findings (testosterone vitamin D levels) if available. All data will be entered into the data collection forms. Only 546 of 1230 participants had vitamin D measurements done.

Definition of osteoporosis: Osteoporosis was defined as a T-score ≤−2.5 at the lumbar spine, femoral neck, or total hip, and osteopenia as a T-score between −1.0 and −2.5.

Primary outcome: The primary outcome of the study is to find out the prevalence of osteoporosis in Indian urban males aged above 40 years who attend a preventive health care program in Max Super Specialty Hospital Saket, New Delhi.

Secondary outcome: This study will provide adequate data, which will help identify the risk factors for osteoporosis in males and, in turn, enable the prevention of complications of osteoporosis and will improve the prognosis. Also, to provide statistically relevant information on average age-matched bone mineral density in the reference population.

Statistical Methods: All the available data were segregated, refined, and uploaded to an MS Excel spreadsheet and analyzed by SPSS version 26 in

Windows format. The continuous variables were denoted as mean and standard deviation, and the categorical variables were denoted as frequency and percentages. The Chi-square test was used to analyze the differences between two groups. ANOVA analysis was done for differences between three or more groups. Values of p (<0.05) were considered significant.

RESULTS

A total of 1230 adult male participants were included in the study. The mean age was 55.89 ± 10.34 years. Most participants were aged 40–59 years (64.1%), followed by those aged 60–79 years (34.1%), while 23 (1.9%) were aged ≥80 years [Table 1].

Table 1: Age Distribution of Study Participants

Age Group (Years)	Frequency (n)	Percentage (%)
40 - 59	788	64.1
60 - 79	419	34.1
≥80	23	1.9
Total	1230	100
Mean Age:	55.89 ±10.34 years	

Regarding personal history and risk factors, 182 participants (14.8%) reported a history of smoking, while 85.2% were non-smokers. The majority followed a mixed diet (78.0%), whereas 22.0% were vegetarian. A history of fracture was reported by 47 participants (3.8%), while a family history of osteoporosis was reported by 0.5% [Table 2].

Table 2: Personal History and Risk Factors

Variable	Frequency (n)	Percentage (%)
Smoking History		
Yes	182	14.8
No	1048	85.2
Dietary Habits: Mixed Diet	960	78
Vegetarian	270	22
Risk Factors		
Family History of Osteoporosis	6	0.5
Past History of Fracture	47	3.8

Serum calcium was ≥8 mg/dL in 1229 participants (99.9%), while one participant (0.1%) had a level below 8 mg/dL. Serum 25-hydroxyvitamin D3 was available for 546 participants. Among these, 296 (54.2%) were vitamin D deficient (<20 ng/mL), 135 (24.7%) were insufficient (20–29 ng/mL), and 115 (21.1%) had normal levels (≥30 ng/mL) [Table 3; Figure 1].

Table 3: Laboratory Parameters

Parameter	Category	Frequency (n)	Percentage (%)
Serum Calcium (3g/dL) (N =1230)			
	<8	1	0.1
	≥ 8	1229	99.9
25-OH Vitamin D3 (ng/mL) (N=546)			
	<20 (Deficient)	296	54.2
	20-29 (Insufficient)	135	24.7
	≥ 30 (Normal)	115	21.1

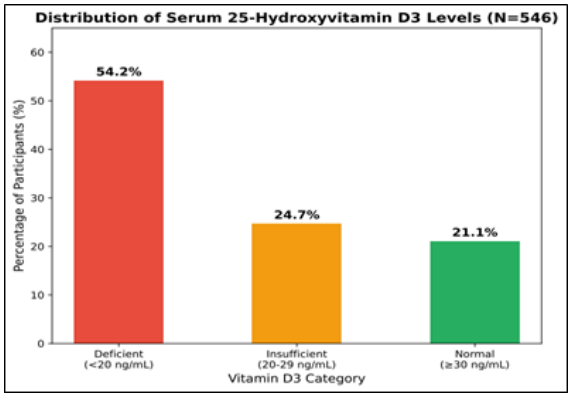

Figure 1: distribution of serum vitamin D3 in the cohort

Assessment of overall bone health showed that 507 participants (41.2%) had normal bone mineral density, 565 (45.9%) had osteopenia, and 158 (12.8%) had osteoporosis [Table 4]. Thus, 58.7% of participants had either osteopenia or osteoporosis.

Site-specific assessment showed that osteoporosis was most frequently observed at the lumbar spine (L1–L4), affecting 88 participants (7.2%), followed by the left femoral neck (6.3%), left total femur (2.8%), and right femoral neck (2.3%). Osteopenia was most frequent at the left femoral neck (36.5%), followed by the left total femur (28.5%), right femoral neck (27.9%), and lumbar spine (26.7%) [Table 5].

Table 4: Prevalence of Osteoporosis and Osteopenia

Bone Health Category	Frequency (n)	Percentage (%)
Normal	507	41.2
Osteopenia	565	45.9
Osteoporosis	158	12.8
Total	1230	100

Table 5: Site-Specific Prevalence of Osteopenia and Osteoporosis

Bone Health Category	Spine (Ll-L4) n (%)	Femur Neck (Left) n (%)	Femur Neck (Right) n (%)	Femur Total (Left) n (%)
Normal	813 (66.1)	704 (57.2)	859 (69.8)	844 (68.6)
Osteopenia	329 (26.7)	449 (36.5)	343 (27.9)	351 (28.5)
Osteoporosis	88 (7.2)	77 (6.3)	28 (2.3)	35 (2.8)

A significant association was observed between age and bone health status (p<0.001). Among participants aged 40–59 years, 43.0% had normal bone health, 47.1% had osteopenia, and 9.9% had osteoporosis. In the 60–79-year age group, (38.4%) had normal bone health, (44.2%) had osteopenia, and (17.4%) had osteoporosis. Among participants aged ≥80 years, (30.4%) had normal bone health, (39.2%) had osteopenia, and (30.4%) had osteoporosis [Table 6]. Thus, the proportion of osteoporosis increased progressively with advancing age.

Table 6: Association of Osteoporosis with Age and BMI

Variable	Category	Normal n (%)	Osteopenia n (%)	Osteoporosis n (%)	p-value
Age					
	40 - 59 yrs	339 (43.0)	371 (47.1)	78 (9.9)	<0.001
	60 - 79 yrs	161 (38.4)	185 (44.2)	73 (17.4)	
	≥ 80 yrs	7 (30.4)	9 (39.2)	7 (30.4)	
BMI (Kg/m2)					<0.001
	18.5	2 (15.4)	7 (53.8)	4 (30.8)	
	18.5 - 24.9	99 (29.4)	174 (51.6)	64 (19.0)	
	25 - 29.9	249 (43.0)	274 (47.2)	57 (9.8)	
	30 - 34.9	134 (52.8)	91 (35.8)	29 (11.4)	
	35 - 39.9	19 (50.0)	15 (39.5)	4 (10.5)	
	≥ 40	4 (50.0)	4 (50.0)	0 (0.0)	

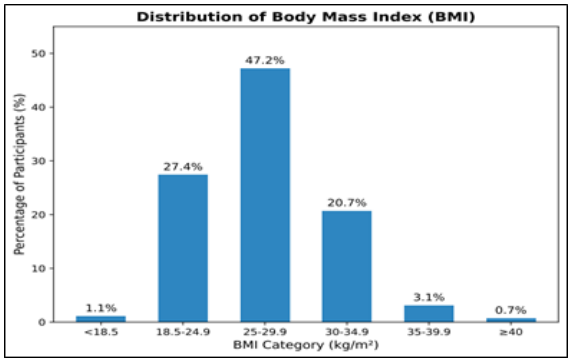

Figure 2: Distribution of BMI in the cohort

BMI was also significantly associated with bone health status (p<0.001). Osteoporosis was present in 30.8% of participants with BMI <18.5 kg/m², compared with 19.0% among those with BMI 18.5–24.9 kg/m², 9.8% among those with BMI 25–29.9 kg/m², 11.4% among those with BMI 30–34.9 kg/m², 10.5% among those with BMI 35–39.9 kg/m², and none of the participants with BMI ≥40 kg/m². The distribution of BMI categories is also illustrated in [Table 6, Figure 1&2].

No statistically significant association was observed between bone health status and dietary pattern (p=0.282). Osteoporosis was present in 12.5% of participants consuming a mixed diet and 14.1% of vegetarians. Similarly, smoking history was not significantly associated with bone health status (p=0.367), with osteoporosis observed in 12.6% of participants with a history of smoking (Table 7). History of fracture was also not significantly associated with bone health status (p=0.288), although osteoporosis was observed in 19.2% of participants with a previous fracture. Family history of osteoporosis showed no significant association (p=0.174); among the six participants reporting such a history, five (83.4%) had osteopenia and none had osteoporosis [Table 7].

Table 7: Association of Osteoporosis with other variables

Variable	Category	Normal n (%)	Osteopenia n (%)	Osteoporosis n (%)	p-value
Type of Diet	Mixed Diet	407 (42.4)	433 (45.1)	120 (12.5)	0.282
	Vegetarian	100 (37.1)	132 (48.8)	38 (14.1)	
Smoking History	Yes	67 (36.8)	92 (50.6)	23 (12.6)	0.367
Past History of Fracture	Yes	15 (31.9)	23 (48.9)	9 (19.2)	0.288
Family History of Osteoporosis	Yes	1 (16.6)	5 (83.4)	0 (0.0)	0.174
Diabetes Mellitus	Yes	82 (46.4)	75 (42.4)	2 (11.2)	0.322
Thyroid Disease	Yes	16 (42.1)	17 (44.8)	5 (13.1)	0.989
Bronchial Asthma	Yes	3(21.4)	7(50.0)	4(28.6)	0.127
Anticonvulsant use	Yes	1 (33.3)	2 (66.7)	0 (0.0)	0.7
Steroid use	Yes	2 (20.0)	3 (30.0)	5 (50.0)	0.002

Among the assessed comorbidities, diabetes mellitus (p=0.322), thyroid disease (p=0.989), and bronchial asthma (p=0.127) were not significantly associated with bone health status. Osteoporosis was observed in 11.2% of participants with diabetes, 13.1% of those with thyroid disease, and 28.6% of those with

bronchial asthma [Table 7, Figure 2]. Anticonvulsant use was not significantly associated with bone health status (p=0.700). In contrast, steroid use showed a statistically significant association with bone health status (p=0.002). Among the 10 participants reporting steroid use, 5 (50.0%) had osteoporosis, 3 (30.0%) had osteopenia, and 2 (20.0%) had normal bone health [Figure 3].

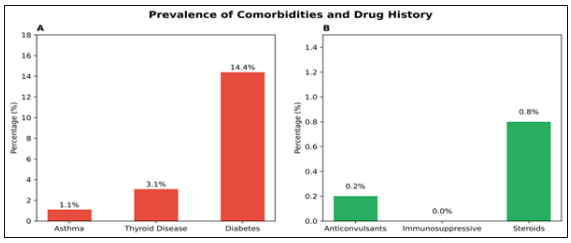

Figure 3: Prevalence of comorbidities and drug history in the cohort

DISCUSSION

The present study of 1230 adult Indian males showed that 12.8% of men in the study had osteoporosis and 45.9% had osteopenia. This indicates that more than half of the study population suffered from impaired bone health. This prevalence is similar to other Indian and international populations reported, with significant geographical variations. Agrawal et al,[10] found that in otherwise healthy Indian men ≥50 years of age, the prevalence of osteoporosis was 8.5%, and of osteopenia 42%. Similarly, Shetty et al,[11] reported the presence of osteoporosis and osteopenia as 20% and 58%, respectively. Marwaha et al,[12] have reported a significantly higher prevalence among the healthy adult population of Delhi aged >50 years. Variations may be due to differences in age structure, population characteristics, skeletal sites measured, and diagnostic techniques. Age was significantly associated with bone health (p<0.001). The prevalence of osteoporosis increased from 9.9% in participants aged 40–59 years to 17.4% in those aged 60–79 years and 30.4% among those aged ≥80 years. This finding is consistent with previous studies in Indian men showing progressive deterioration of BMD with advancing age. Shetty et al,[11] found significantly higher femoral-neck osteoporosis among men aged >60 years, while Agrawal et al,[10] demonstrated declining femoral-neck BMD with increasing age. Age-related bone loss is attributable to increased bone resorption, cortical thinning and increased cortical porosity, resulting in progressive reduction in bone strength. BMI was also significantly associated with bone health (p<0.001). Osteoporosis was particularly frequent among participants with BMI <18.5 kg/m² (30.8%), whereas no osteoporosis was observed in the small group with BMI ≥40 kg/m². These findings agree with studies demonstrating a positive association between BMI and BMD. Marwaha et al,[12] reported a positive correlation between BMI and BMD in Indian adults. Our study results show bone health was significantly related to age (p<0.001). The prevalence of osteoporosis rose from 9.9% in the age group 40-59 years to 17.4% in the age group 60-79 years. Similarly, prevalence was 30.4% in the age group ≥ 80 years. Our result is similar to previous studies in the Indian male population, which indicated that there is a progressive decrease in BMD as age increases. Shetty et al. reported significantly lower femoral-neck osteoporosis in men of age >60 years, and Agrawal et al,[10] reported decreasing femoral-neck BMD with increasing age. Age-related bone loss is caused by increased bone resorption, cortical thinning, and increased cortical porosity, which contributes to a progressive loss in bone strength. BMI was also significantly related to bone health (p<0.001). Among the participants, those who had a BMI <18.5 kg/m² (30.8%) had a high incidence of osteoporosis, while the few with a BMI ≥40 kg/m² showed no osteoporosis. These results support previous studies which showed a positive correlation between BMI and BMD. Marwaha et al,[12] reported a positive correlation between BMI and BMD in Indian adults. El Maghraoui et al,[13] found low BMI to be an independent risk factor for osteoporosis in Moroccan males. The association may include mechanical loading, body composition, and nutritional status variations.

The current study did not find any significant association with smoking and osteoporosis (p=0.367), although 12.6% of smokers were osteoporotic. The lack of statistical significance could be partially due to the small number of smokers (14.8%). However, other evidence suggests that smoking is related to decreased BMD, especially at the hip; therefore, the lack of significance in this study should not be interpreted as no effect.[14] Similarly, dietary pattern, previous fracture, family history, diabetes, thyroid disease, asthma, and anticonvulsant use were not significantly associated with bone health. There was a significant association between steroid use and osteoporosis (p=0.002). Half of the participants receiving steroids had osteoporosis, although only 0.8% of the study population reported steroid use. This can be explained by the fact that corticosteroid use is known to decrease BMD and increase risk of osteoporotic fracture. However, this association should be taken with caution, due to the small number of steroid users involved.[15] Vitamin D deficiency was prevalent with 54.2% of 546 tested participants, but was not significantly associated with osteoporosis. This result is in agreement with the study by Marwaha et al., who did not find any correlation between serum 25(OH)D and BMD; however, some Indian studies have reported a negative association between serum 25(OH)D and BMD. Moreover, vitamin D deficiency is still a high-prevalence condition that is clinically pertinent among Indians.[16] Overall, this study found that there is a substantial burden of low bone mass among adult Indian males, with advancing age, low BMI and steroid exposure emerging as important associated factors. The findings support greater

attention to osteoporosis screening and risk-factor assessment in men, particularly those who are elderly, underweight or exposed to corticosteroids.

CONCLUSION

This prospective observational study of 1230 urban Indian men found a substantial burden of impaired bone health, with 12.8% having osteoporosis and 45.9% having osteopenia. The prevalence of osteoporosis increased progressively with advancing age. Age, BMI, and steroid use were significantly associated with osteoporosis. Whereas smoking, dietary pattern, previous fracture, family history, diabetes, thyroid disease, asthma, anticonvulsant use, serum calcium, and vitamin D status were not significantly associated. As this was a single-centre study, multicentre studies involving diverse Indian populations and longitudinal follow-up are warranted to evaluate disease progression and future fracture risk.

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