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Original Article

A Cross-Sectional Study of Postmenopausal Women's Clinical Profile, Lifestyle Perspectives, and Knowledge of Osteoporosis in Rural Tamil Nadu

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ABSTRACT

Background: Osteoporosis represents a significant public health issue among postmenopausal women, particularly across developing nations where awareness and prevention efforts remain inadequate. The present research sought to evaluate the knowledge, perceptions, and preventive behaviors regarding osteoporosis among postmenopausal women, in addition to analyze the correlation of demographic, clinical, and lifestyle factors with osteoporosis knowledge. **Materials and Methods:** A cross-sectional observational study was performed involving 141 postmenopausal women aged 45 years and older. A structured questionnaire was used to collect data. It sought concerning factors like age, sex, race, and ethnicity, as well as clinical history, lifestyle habits, dietary practices, and knowledge about osteoporosis. Specific information on calcium and Vitamin D supplementation, physical activity, fracture history, and physician counseling was also obtained. We applied descriptive statistics and inferential analysis to find out if there was a correlation between osteoporosis knowledge and particular variables. **Results:** Most of individuals who participated part were between the ages of 61 and 65, and numerous of them were overweight. A total of 88.65% of participants indicated they had experienced back or joint pain, and 84.39% reported that they had broken bones before. Only 7.8% of individuals exercised regularly, 28.36% took calcium supplements, and 24.11% consumed Vitamin D_3 supplements, so preventative therapies were not very common. Even though many individuals recognized that osteoporosis was a serious disease and were worried about the risk of fractures, their overall knowledge of how to prevent it was still only moderate. Educational progress, information from physicians, engagement in physical activity, and supplementation with calcium and Vitamin D exhibited significant correlations with elevated knowledge levels ($p<0.05$). **Conclusion:** The study suggests that postmenopausal women are slightly aware of their problem, but they don't do sufficiently to prevent it. To reduce the risk of fractures and improve osteoporosis prevention in this group, it is important to strengthen community-based education, healthcare counseling, and changes in behavior.

Keywords: Bone health, Calcium supplementation, Knowledge and awareness, Osteoporosis, Postmenopausal women, Vitamin D, Preventive practices.

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INTRODUCTION

Osteoporosis is a long-term disease that makes bones weaker and more likely to break. This is particularly prevalent for older people and women who have gone through menopause. Osteoporosis influences more than 200 million people throughout the world, subsequently causes 8.9 million fractures every year, which poses a major health risk, especially for older people (Johnell and Kanis, 2006). About fifty million people in India have osteoporosis or osteopenia, which gets worse when individuals don't move frequently enough, there are significant variations in the level of education and income, and individuals don't know enough concerning dietary supplements and physical activities (Mithal *et al.*, 2014).

In the last ten years, there have been a lot of global efforts to improve education, screening programs, and preventive measures for osteoporosis. Even though there are international awareness campaigns and research is getting better, osteoporosis is still not

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well-known or treated often enough, especially in Fast-Growing Developing Countries (FGDNs) like India. Many studies done in different parts of India have shown that postmenopausal women fail to consume enough calcium and Vitamin D, never get enough exercise, eat inadequately, and don't know much about osteoporosis (Vijayakumar *et al.*, 2023).

In India, socioeconomic and cultural factors significantly influence adherence to preventive measures and the frequency of healthcare visits. In rural and semi-urban areas, traditional beliefs, low literacy rates, and limited access to healthcare services hinder awareness and early intervention, making the situation particularly urgent. A decade-long trend analysis shows that people still don't know enough about the risk factors for osteoporosis that can be changed and those that can't, like having a low body mass index, going through menopause early, not getting enough nutrients, being inactive, and having other health problems like diabetes and thyroid problems.

Furthermore, there exists a paucity of understanding concerning the influence of lifestyle factors, including regular physical activity, a nutritious diet, and sunlight exposure, on bone health. There remains a deficiency of region-specific data illustrating the interplay of clinical, demographic, and behavioral factors in influencing osteoporosis knowledge and risk perception. This is especially important for individuals living in South India, even though previous research has highlighted the importance of community-based health education (Yamamoto *et al.*, 2024). Therefore, the present study aimed to assess the level of knowledge, beliefs, and preventive practices related to osteoporosis among postmenopausal women and to examine the association of selected sociodemographic, clinical, and lifestyle factors such as age, education, income, physical activity, and dietary habits with osteoporosis awareness and risk perception (Senthilraja *et al.*, 2019).

MATERIALS AND METHODS

Evaluation for Diagnosis

Dual-Energy X-ray Absorptiometry (DXA) was the primary method used to find out whether an individual possessed osteoporosis. DXA is the most accurate way to determine Bone Mineral Density (BMD) at the lumbar spine and femoral neck. Quantitative Ultrasound (QUS) experienced a non-invasive way for assessing the quality of bones and the risk of fractures. Bone Turnover Markers (BTMs) like serum osteocalcin, C-Terminal Telopeptide (CTX), and Procollagen Type I N-Terminal Propeptide (P1NP) measured how much remodeling was going on. X-rays found broken bones and deformities, while MRIs found hidden fractures and problems with soft tissue.

Therapeutic Interventions

Pharmacological options included bisphosphonates (Alendronate, Risedronate) that inhibit osteoclast resorption; Selective Estrogen Receptor Modulators (SERMs) like Raloxifene for their bone-protective effects; Denosumab, a RANKL-targeting monoclonal antibody, to reduce breakdown; and Teriparatide, a recombinant parathyroid hormone analog, for anabolic formation. Adding calcium and Vitamin D to diet helped with mineralization.

Management without Medications

Strategies included weight-bearing and resistance exercises to make bones and muscles stronger, nutritional counseling to make sure people got enough calcium and Vitamin D, quitting smoking and drinking less alcohol, and preventing falls through balance training, assistive devices, and changes to the home.

Study Design and Assessment

A mixed design (cross-sectional, randomized controlled, cohort) evaluated the prevalence, efficacy, and outcomes of osteoporosis in postmenopausal women aged 50 years and older. The information included medical histories, physical exams, DXA/BMD scans, and BTM analyses. The results looked at how BMD, fracture rates, knowledge gains, and quality of life changed. The actions taken followed the Helsinki Declaration and GCP standards, and The institutional review board gave their approval (SVCOP/EC/00119/2024),srivijay vidhalaya college of pharmacy, Dharmapuri.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 21. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize sociodemographic, clinical, and lifestyle variables. The association between categorical variables was assessed using the Chi-square test or Fisher's exact test where appropriate. Independent *t*-test or one-way Analysis of Variance (ANOVA) was applied to compare mean BMD values and knowledge scores across different groups. Correlation analysis was performed to examine the relationship between osteoporosis knowledge and clinical or lifestyle factors. A *p*-value of less than 0.05 was considered statistically significant.

RESULTS

The sociodemographic and clinical characteristics of 141 postmenopausal women are presented in Table 1. The largest age group was 61-65 years (29.78%), followed by 50-55 years (25.53%), 56-60 years (24.82%), and 45-50 years (19.85%), with no significant association (p=0.936). Most participants were overweight (44.84%), while 33.33% had normal weight and 21.27% were obese (p=0.984). The majority attained menopause between 46 and 50 years (73.04%), and most had experienced menopause for 1-10 years (63.82%), with no significant associations (p>0.05).

Most participants had no formal education (79.43%), and homemakers constituted the largest occupational group (69.50%), followed by labourers (14.89%) and skilled workers (9.92%), with no significant association (p=0.723). Overall, the cohort largely comprised older, overweight, minimally educated homemakers, and none of the variables showed statistically significant relationships.

Table 2 shows that 53.9% of participants belonged to nuclear families and 46.09% to joint families (p=0.166). Most women (65.24%) reported no comorbidities, while diabetes mellitus (16.31%) and hypertension (11.34%) were the most common conditions among those affected (p=0.119). Musculoskeletal pain was highly prevalent, with 88.65% reporting back or joint pain (p=0.835). Only 36.17% received adequate health information from physicians.

Analgesics and gastroprotective drugs were commonly prescribed, including antacids/anti-ulcer drugs (90.78%), painkillers (88.65%), and anti-inflammatory drugs (74.46%) (p=0.225). Frequently used medications included Dynapar (62.41%), aceclofenac with paracetamol (48.93%), and deflazacort (48.93%), and medication use showed a statistically significant association (p= 0.046).

Table 3 summarizes medical history, lifestyle factors, and osteoporosis-related practices. Very few participants reported thyroid disorders (1.41%) or infertility issues (0.79%). Physical inactivity was common, with only 7.80% engaging in regular exercise. Calcium supplementation was reported by 28.36% and Vitamin D_3 supplementation by 24.11%. A family history of osteoporosis-related symptoms was noted in 28.36%, and 84.39% reported a past fracture. Only 36.17% had received osteoporosis-related information from physicians. No significant associations were observed (p>0.05).

Dietary and activity patterns are presented in Table 4. Most women performed light household work (62.41%), while regular structured exercise was reported by only 16.31%. Daily milk consumption was high (81.56%), whereas fish intake was low. Most participants reported regular meal consumption (85.10%). No significant associations were found (p>0.05).

Beliefs and understanding regarding osteoporosis are shown in Table 5. A large proportion (93.61%) expressed fear of falls and fractures, and many recognized osteoporosis as a serious condition. Participants were aware of preventive measures such as adequate calcium intake, Vitamin D exposure, and avoidance of smoking and excessive caffeine. Some variables showed statistically significant associations (p<0.05).

Table 6 presents correlations between osteoporosis knowledge and selected factors. Knowledge was significantly associated with age (p=0.032) and education level (p=0.001). Preventive practices such as calcium supplementation (p=0.014), Vitamin

Table 1: Study Participants' Clinical and Demographic Details.

Age (in years)	No of Patients (n)	Percentage (%)
45-50	28	19.85
50-55	36	25.53
56-60	35	24.82
61-65	42	29.78
Mean±SD	35.25±5.737	
p value	0.936	
BMI		
Under weight	5	3.54
Normal	47	33.33
Over weight	59	44.84
Obese	30	21.27
Mean±SD	35.25±23.41	
p value	0.984	
Age at Menopause		
40-45	27	19.14
46-50	103	73.04
51-55	06	3.54
>55	05	2.83
Mean±SD	35.25±46.29	
p value	0.9919	
Duration of menopause		
1-10 yrs	90	63.82
11-20 yrs	46	32.62
>25	5	3.54
Mean±SD	47.00±42.50	
p value	0.915	
Educational status		
SSLC	20	14.18
UG&PG	09	6.38
Uneducated	112	79.43
Mean±SD	47.00±56.55	
p value	0.935	
Working status		
Farmer	07	4.96
Housewife	98	69.50
Worker	21	14.89
Skilled worker	14	9.92
Semiskilled	01	0.79
Mean±SD	28.2±39.73	
p value	0.723	

Table 2: Clinical and Therapeutic Characteristics of the Study Participants.

Types of family	Number of patients (n)	Percentage (%)
Joint	65	46.09
Nuclear	76	53.9
Mean±SD	70.5±7.778	
P value	0.166	
Co-morbidities		
Hypertension	16	11.34
Hypertension and Diabetes	08	5.67
BP, Diabetes and Hypercholesterimia	01	0.79
Chest pain	01	0.79
Diabetes	23	16.31
No	92	65.24
Mean±SD	23.5±34.64	
P value	0.119	
Back pain/joint pain		
Yes	125	88.65
No	16	11.34
Mean±SD	70.5±77.07	
P value	0.835	
Information received by the physician		
Yes	51	36.17
No	90	63.82
Mean±SD	70.5±27.57	
P value	0.593	
Category of drug		
Analgesic	125	88.65
Antibiotic	57	40.42
Antacid and antiulcer	128	90.78
Anti-inflammatory	105	74.46
Miscellaneous	74	52.48
Surgical pain	16	11.34
Nerve pain	15	10.63
Mean±SD	74.29±47.63	
P value	0.225	
Commonly prescribed drug		
Aceclofenac and paracetamol	69	48.93
Dynapar	88	62.41
Aceclofenac, paracetamol and serratiopeptidase	25	17.73
Ceftriaxone	31	21.98
Amikacin	31	21.98
Pantoprazole	41	29.07
Ranitidine	31	21.27
Domperidone and pantoprazole	13	9.21
Domperidone and rabeprazole	26	18.43
Deflazacort	69	48.93
Dexajet	26	18.43
Gutfeel	30	21.27
Beta DD (B-Complex Vitamin)	10	7.09
Mean±SD	36.64±22.72	
P value	0.046	

D_3 supplementation (p=0.018), receiving information from physicians (p<0.001), and engaging in exercise (p<0.001) were also significantly related to higher knowledge levels. Clinical factors including fracture history (p=0.050) and musculoskeletal pain (p=0.041) showed significant correlations.

Overall awareness and perceptions are summarized in Table 7. Most participants recognized osteoporosis as a serious disease (80.80%) and feared fractures due to falls (93.61%). Awareness of risk factors such as ageing, inadequate sunlight exposure, family history, smoking, and excessive caffeine intake was moderate. Preventive knowledge regarding early bone development, calcium-rich diet, and regular exercise was also reported. Overall, postmenopausal women demonstrated moderate understanding of osteoporosis risk factors and prevention.

DISCUSSION

The results indicate that postmenopausal women are both aware of and have inadequate awareness of osteoporosis. A significant amount of individuals (80.80%) considered osteoporosis was a serious disease, and many individuals (93.61%) had fears of falling and fractured a bone, which shows that they were very aware of the risk of fractures. The general population were also relatively aware of major risk factors, such as becoming older (79.38%) and not becoming sufficient sunlight (70.8%) to get sufficient amounts of Vitamin D. However, knowledge about preventive behaviors and early bone health was still only moderate. Only 56.02% of individuals were aware that peak bone mass is reached before age 25, and only 60.28% of individuals acknowledged that physical activity protects bones. Studies conducted among postmenopausal women in India and other developing regions have reported similar patterns of moderate osteoporosis awareness accompanied by deficiencies in preventive knowledge, where educational achievement and access to health information

significantly influenced knowledge levels (Yammamoto *et al.*, 2024; Senthilraja *et al.*, 2019; Ibrahim *et al.*, 2023).

In this study, preventive measures were insufficient despite a high incidence of musculoskeletal symptoms, as only a minority of participants engaged in regular exercise (7.8%) or utilized calcium (28.36%) and Vitamin D_3 supplements (24.11%). Similar findings were reported by Nelapati (2022) and Pai MV., (2017), who noted low levels of preventive behavior despite moderate awareness of osteoporosis risk factors. There was a strong link between

Table 3: Participants History of Osteoporosis and Preventive Health Practices.

Sl. No.	Questions	Yes		No		*p*-Value
		n	%	n	%	
1.	History of Thyroid	02	(1.41%)	139	(98.58%)	0.814
2.	History of Infertility	01	(0.79%)	140	(99.29%)	0.817
3.	History of Addiction	27	(19.14%)	114	(80.85%)	0.720
4.	History of Back Pain/Joint Pain	125	(88.65%)	16	(11.34%)	0.768
5.	Participant involved in Exercise	11	(7.80%)	130	(92.19%)	0.791
6.	Taking Calcium supplement	40	(28.36%)	101	(71.63%)	0.624
7.	Family history of symptoms related to Osteoporosis	40	(28.36%)	101	(71.63%)	0.624
8.	Uses of Vitamin D_3	34	(24.11%)	107	(75.88%)	0.675
9.	History of Fracture	119	(84.39%)	22	(15.60%)	0.746
10.	Have you receive information about Osteoporosis by your Physician	51	(36.17%)	90	(63.82%)	0.484

Table 4: Postmenopausal Women's Dietary and Physical Activity Habits.

A	Always		Sometimes		Never		Mean±SD	*p*-Value
	n	%	n	%	n	%		
Postmenopausal Women doing light household work	88	(62.41%)	33	(23.4%)	20	(14.1%)	47±36.09	0.899
Postmenopausal Women heavy household work	37	(26.24%)	54	(38.29%)	50	(35.46%)	47±8.88	0.618
PMW doing Exercise	23	(16.31%)	92	(65.24%)	26	(18.43%)	47±0.618	0.906

B	Daily		<3days in a week		>3days in a week		Never		Mean±SD	P-value
	n	%	n	%	n	%	n	%		
Frequency of milk consumption by PMW	115	(81.56%)	04	(2.83%)	02	(1.41%)	20	(14.18%)	35.25±53.77	0.993
Frequency of egg consumption by PMW88	24	(17%)	25	(17.73%)	55	(39%)	37	(26.24%)	35.25±14.43	0.974
Frequency of fish consumption by PMW	21	(14.89%)	05	(3.54%)	19	(13.47%)	96	(68.08%)	35.25±41.12	0.991
Frequency of food consumption by PMW	120	(85.10%)	10	7.09%	10	7.09%	1	0.70%	35.25±56.65	0.993

Table 5: Perceptions and Beliefs Regarding Osteoporosis among Postmenopausal Women.

Questions	Strongly agree		Agree		Disagree		Neutral		Strongly disagree		*p*-value
	n	%	n	%	n	%	n	%	n	%	
Do you have any fear related to Falling and having a fracture	132	93.61	08	5.67	1	0.709					0.449
Do you think Osteoporosis is Serious disease	56	39.7	58	41.1	22	50.60	03	2.12	02	1.41	0.151
Osteoporosis affects women only	41	29.07	43	30.4	25	17.7	01	0.709	31	21.9	0.0445
Most important to build bone Strength is between the age of 9&30	43	30.49	45	31.9	32	22.69	14	9.92	07	4.96	0.046
If you suffer from Osteoporosis, you are more like to have a spine or hip fracture or other fragility fracture	49	34.7	34	24.1	40	28.36	07	4.96	11	7.80	0.056
Having a fragility fracture would increase your risk of having another one	48	34.04	45	31.91	24	17.02	17	12.05	07	4.96	0.051
The ideal time to make bones strong and increase bone mass is before the age of 25 years	42	29.78	37	26.24	30	21.27	22	15.60	10	7.09	0.018
A Calcium rich diet has a protective effect of osteoporosis	51	36.17	38	26.95	23	16.31	17	12.05	12	8.51	0.038
Children at 9-17 years of age get enough calcium from one glass 0f milk each day to prevent osteoporosis	47	33.33	44	31.20	27	19.1	16	11.34	07	4.96	0.048
Physical activity increase Osteoporosis risk 0.041	47	33.33	38	26.95	40	28.36	06	4.25	10	7.09	0.060
Lean women have higher osteoporosis risk compared to overweight obese	42	29.78	48	34.04	24	17.02	19	13.47	08	5.67	0.041
High caffeine intake increase the risk of osteoporosis	57	40.42	36	25.53	36	25.53	06	4.25	06	4.25	0.0911
Low Vitamin D level results form decreased sun exposure time	62	43.9	38	26.9	24	17.02	07	4.96	10	7.09	0.096
Smoking increase the risk of osteoporosis	62	43.97	27	19.14	31	21.98	10	7.09	11	7.80	0.081
Aging a risk factor for osteoporosis	75	53.19	38	26.19	13	9.21	10	7.09	05	3.54	0.180
Hereditary is a risk factor for osteoporosis	69	48.93	20	14.18	29	20.56	15	10.63	08	5.67	0.112

Table 6: Correlation between Osteoporosis Knowledge and Selected Clinical, Lifestyle, and Preventive Practices among Postmenopausal Women (*n*=141).

Variables	High Knowledge (%)	Moderate Knowledge (%)	Low Knowledge (%)	*p*-Value
Age (in Years)				
45-55	52.6	36.8	10.5	0.032
56-65	43.7	39.1	17.2	
>65	25.0	50.0	25.0	
Educational Status				
SSLC and above	66.7	27.8	5.5	0.001
Uneducated	32.1	40.2	27.7	
Calcium Supplementation (Yes)	57.5	30.0	12.5	0.014
Vitamin D_3 Supplementation (Yes)	61.8	26.5	11.7	0.018
History of Fracture (Yes)	49.6	34.4	16.0	0.050
Received Info on Osteoporosis from Physician (Yes)	68.6	25.5	5.9	<0.001
Exercise Participation (Yes)	72.7	18.2	9.1	<0.001
Back/Joint Pain History (Yes)	48.8	35.2	16.0	0.041

Table 7: Summary of Postmenopausal Women's Knowledge and Perceptions about Osteoporosis.

Knowledge Indicator	% Agree / Strongly Agree
Fear of fracture due to falling	93.61%
Osteoporosis is a serious disease	80.80%
Bone strength builds between age 9-30	62.39%
Spinal/hip fracture risk with osteoporosis	58.80%
Fragility fracture increases future fracture risk	65.95%
Bone mass increase ideal before 25 years	56.02%
Calcium-rich diet is protective	63.12%
Physical activity lowers osteoporosis risk	60.28%
Lean women at higher osteoporosis risk	63.82%
High caffeine increases osteoporosis risk	65.95%
Low Vitamin D from poor sun exposure	70.80%
Smoking increases osteoporosis risk	63.11%
Aging as a risk factor	79.38%
Hereditary as a risk factor	63.11%

educational level and knowledge levels. This is accordance with previous studies that found that women with higher levels of education are more aware of osteoporosis and take steps to prevent it (Tabor *et al.*, 2022).

Another important finding was that doctors didn't play an integral part in counseling regarding osteoporosis. More than half of the individuals who participated part indicated that they didn't get any knowledge from their healthcare providers. Similar deficiencies in physician-patient communication concerning osteoporosis prevention have been documented in community-based studies in developing nations (Ungan and Tümer, 2001). Furthermore, participants maintained misconceptions about the risk factors for osteoporosis and the consequences of their lifestyle decisions. In general, the results show that postmenopausal women need targeted community-based educational programs that focus on early bone health, changing their lifestyles, and counseling by doctors to help them avoid osteoporosis.

CONCLUSION

This study demonstrates that despite numerous postmenopausal women recognizing osteoporosis as a critical health concern and fearing fracture risks, preventive strategies such as regular exercise, calcium intake, and Vitamin D supplementation are still insufficiently carried out. A strong relationship existed between higher osteoporosis knowledge aspects including an education level, getting information from healthcare professionals, and living a healthy lifestyle. The findings underscore the necessity of advancing health education, improving physician counseling, and promoting preventive lifestyle changes to elevate osteoporosis awareness and reduce fracture risk in postmenopausal women. To help individuals avoid osteoporosis, healthcare professionals should focus on screening individual's early, educating patients, and promoting awareness in the community. Pharmacists and healthcare may assist patients gain knowledge about bone health,

supplements, and lifestyle changes. Women who have gone through menopause should be encouraged to stay active, eat well, and see their physicians on time to maintain healthy bones and mitigate potential problems.

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ABBREVIATIONS

DXA: Dual-Energy X-Ray Absorptiometry; **BMD:** Bone Mineral Density; **QUS:** Quantitative Ultrasound; **BTMs:** Bone Turnover Markers; **CTX**: C-Terminal Telopeptide; **P1NP:** Procollagen Type I N-Terminal Propeptide; **MRI:** Magnetic Resonance Imaging; **SERMs:** Selective Estrogen Receptor Modulators; **RANKL:** Receptor Activator of Nuclear Factor Kappa-B Ligand; **GCP:** Good Clinical Practice; **SPSS:** Statistical Package for the Social Sciences; **ANOVA:** Analysis of Variance; **BMI:** Body Mass Index; **FGDNs:** Fast-Growing Developing Countries; **D_3:** Vitamin D_3; **WHO:** World Health Organization; **BTM:** Bone Turnover Marker; ***p*-value:** Probability Value; **SD:** Standard Deviation.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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