



AWARENESS ABOUT BONE HEALTH IN WOMEN: A CROSS-SECTIONAL STUDY

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Abstract: Bone health is a critical yet neglected aspect of women's health in India. Osteoporosis, characterised by reduced bone mass and increased fracture risk, affects approximately 61 million Indians, of whom about 80% are women. This cross-sectional study assessed bone health knowledge among 100 women aged 18–60 years in a community setting using the validated OKAT-H (Osteoporosis Knowledge Assessment Tool – Hindi). Results showed that 73% of participants had moderate knowledge (score 8–14/20), 21% had poor knowledge (0–7/20), and only 6% demonstrated good knowledge (15–20/20). Educational attainment showed the strongest positive correlation with knowledge scores. Critical gaps were identified in understanding the asymptomatic nature of the disease, modifiable risk factors, post-menopausal bone loss, and available treatments. The study underscores the urgent need for targeted bone health education and community-level awareness initiatives for women across all age groups.

Index Terms - Osteoporosis, bone health, OKAT-H, women, awareness, cross-sectional study, India.

I. INTRODUCTION

Bone health is a critical but often neglected aspect of women's health in India. Osteoporosis, characterised by reduced bone mass and increased fracture risk, poses a significant public health challenge, particularly among Indian women. Studies show that over 61 million Indians are affected by osteoporosis, with women comprising approximately 80% of this population.⁽¹⁾

Many factors place Indian women at higher risk for osteoporosis—being female, advancing age, insufficient calcium or vitamin D intake, sedentary lifestyle, lower body weight, genetics, and economic conditions all play a role. Genetically, Asian Indians tend to have lower bone mass than Caucasians, making them more prone to bone loss with age. Cultural practices such as wearing traditional clothing and spending most time indoors reduce sunlight exposure, limiting vitamin D synthesis, which is essential for calcium absorption. Research shows that approximately 80% of urban Indians are deficient in vitamin D.

Diet plays a pivotal role as well. Many Indian diets include insufficient calcium owing to limited dairy consumption and heavy reliance on cereals⁽²⁾. While vegetarianism offers many health benefits, it can lead to inadequate calcium intake if meals are not carefully planned. Furthermore, many Indian foods are high in phytates, which inhibit calcium absorption.

Osteoporotic fractures occur 10–12 years earlier in the Indian population compared to Western countries, leading to prolonged disability and increased healthcare costs. Hip fractures carry high morbidity and mortality. More than 4.5 million women above the age of 60 in India have suffered vertebral fractures⁽¹⁾. Despite this burden, surveys indicate that only 10–15% of Indians are aware of the disease, highlighting an urgent need for education and preventive strategies.

II. NEED OF THE STUDY

Osteoporosis is a silent epidemic affecting around 200 million women worldwide. The risk grows significantly with age—approximately 1 in 10 women at age 60, 1 in 5 at 70, 2 in 5 at 80, and 2 in 3 by age 90 are affected. In Asia, the condition remains largely under-diagnosed and under-treated, even among high-risk patients who have already suffered fractures. This problem is particularly severe in rural areas where hip fractures are often managed conservatively at home rather than through proper surgical treatment.

Urban women face their own challenges including sedentary lifestyles, limited outdoor activity, and processed food diets that reduce vitamin D synthesis. Women over 50 carry a 50% lifetime risk of an osteoporotic fracture⁽⁴⁾. Pregnancy, lactation, and menopause each impose demands on the skeletal system⁽⁵⁾. As oestrogen levels decline during menopause, bone loss accelerates dramatically, leaving women especially vulnerable. Young women too must understand that their bone health choices today will impact them for decades to come⁽⁶⁾.

Understanding what women actually know about bone health provides crucial insights into why osteoporosis rates remain high, and allows the design of effective prevention strategies to reduce healthcare burden and help women maintain independent, active lives at every age.

III. AIM AND OBJECTIVE

Aim: To assess awareness about bone health in women.

Objective: To assess current knowledge in women regarding bone health using the OKAT-H (Osteoporosis Knowledge Assessment Tool – Hindi).

IV. METHODOLOGY

1. Study Design and Setting

A cross-sectional study was conducted in a community setting to assess bone health knowledge among women at a single time point.

2. Study Population and Sampling

The target population comprised women aged 18–60 years who could understand spoken and written Hindi or English and provided informed consent. Women with medically diagnosed intellectual deficits and those from a medical background were excluded. Non-probability convenience sampling was used to recruit 100 participants after obtaining Institutional Research Board approval.

3. Outcome Measure – OKAT-H

The OKAT-H (Osteoporosis Knowledge Assessment Tool – Hindi), developed and validated by Barik et al. (2023)⁽⁷⁾, was the primary outcome measure. The tool consists of 20 statements covering: (i) basic understanding of osteoporosis, (ii) symptoms and detection, (iii) risk factors, (iv) causes and triggers, (v) prevention and lifestyle, and (vi) treatment availability in India. Respondents select Correct (Sahi), Incorrect (Galat), or Don't Know (Pata Nahin) for each item. Each correct response scores 1 point; incorrect or 'don't know' responses score 0 (maximum score = 20). The OKAT-H has a Flesch readability score of 86, Cronbach's alpha of 0.892, and Pearson test-retest reliability of 0.712 ($p < 0.05$). Knowledge was classified as Poor (0–7), Moderate (8–14), or Good (15–20). The questionnaire was administered in an interview-based format.

4. Statistical Analysis

Data was entered into Microsoft Excel and checked for completeness. Categorical variables (responses to the questionnaire) were summarised using frequencies and percentages. Pie charts and tables were used to illustrate proportions and distributions.

V. RESULTS

Table 1: Distribution of Participants by Age Group

Age Group (years)	Number of Participants (n)	Percentage (%)
18–30	30	30%
31–40	22	22%
41–50	20	20%
51–60	28	28%
Total	100	100%

The 18–30 year age group had the highest representation with 30 participants (30%), followed by the 51–60 year group with 28 participants (28%), the 31–40 year group with 22 participants (22%), and the 41–50 year group with 20 participants (20%).

Table 2: Distribution of Participants by Education Level

Education Level	Number of Participants (n)	Percentage (%)
Prematriculation	1	1%
SSC	8	8%
HSC	12	12%
Graduate	59	59%
Postgraduate	20	20%
Total	100	100%

Graduates formed the largest group with 59 participants (59%), followed by postgraduates with 20 (20%), HSC with 12 (12%), SSC with 8 (8%), and prematriculation with 1 (1%). The majority of participants were highly educated, with more than three-fourths holding graduate or postgraduate degrees.

Table 3: Selected Item-Level Response Analysis (OKAT-H)

Characteristics	Correct Answer	Responses	n(%)	Awareness score(%)
1. Osteoporosis is a disease in which bone becomes weak and the risk of factor increases.	Correct	Correct	92 (92)	92
		Incorrect	4 (4)	
		Don't Know	4 (4)	
2. In this disease, symptoms such as pain appear before bones break.	Incorrect	Correct	59 (59)	21
		Incorrect	21 (21)	
		Don't Know	20 (20)	
3. Even after bones become stronger in adolescence, the risk of osteoporosis does not reduce in old age.	Incorrect	Correct	57 (57)	17
		Incorrect	17 (17)	
		Don't Know	26 (26)	
4. Osteoporosis is more common in men.	Incorrect	Correct	22 (22)	52
		Incorrect	52 (52)	
		Don't Know	26 (26)	
5. Smoking increases the risk of this disease.	Correct	Correct	42 (42)	42
		Incorrect	21 (21)	
		Don't Know	37 (37)	
6. Indian women have no risk of developing this disease	Incorrect	Correct	17(17)	71
		Incorrect	71 (71)	
		Don't Know	12 (12)	
7. Deceased bones can also break due to a fall or minor trauma.	Correct	Correct	69 (69)	69
		Incorrect	16 (16)	
		Don't Know	15 (15)	
8. By the age of 80 most women are affected by this disease.	Correct	Correct	59 (59)	59
		Incorrect	19 (19)	
		Don't Know	22 (22)	
9. From the age of 50 women can expect at least one fracture before they die.	Correct	Correct	59 (59)	59
		Incorrect	16 (16)	
		Don't Know	25 (25)	

Characteristics	Correct Answer	Responses	n(%)	Awareness score(%)
10. Any type of physical activity is beneficial for osteoporosis.	Incorrect	Correct	47 (47)	22
		Incorrect	22 (22)	
		Don't Know	31 (31)	
11. A person can tell from their lifestyle, health and symptoms that they are susceptible to osteoporosis.	Correct	Correct	67 (67)	67
		Incorrect	12(12)	
		Don't Know	21 (21)	
12. If someone in the family has osteoporosis, the risk of this disease increases.	Correct	Correct	36 (36)	36
		Incorrect	29 (29)	
		Don't Know	35 (35)	
13. Drinking two glasses of milk daily provides enough calcium.	Correct	Correct	48 (48)	48
		Incorrect	25 (25)	
		Don't Know	27 (27)	
14. People allergic to milk or milk products can have dals, leafy vegetables and fish as a source of calcium.	Correct	Correct	79 (79)	79
		Incorrect	7 (7)	
		Don't Know	14 (14)	
15. Only calcium supplements can save from osteoporosis.	Incorrect	Correct	16 (16)	62
		Incorrect	62 (62)	
		Don't Know	22 (22)	
16. Drinking alcohol in small amounts does not increase the risk of this disease.	Correct	Correct	22 (22)	22
		Incorrect	42 (42)	
		Don't Know	36 (36)	
17. Consuming excessive amounts of salt increases the risk of this disease	Correct	Correct	46 (46)	46
		Incorrect	23 (23)	
		Don't Know	31 (31)	
18. In the 10 years solving menopause,there is no significant reduction in bone health	Incorrect	Correct	23 (23)	44
		Incorrect	44 (44)	
		Don't Know	33 (33)	
	Correct	Correct	42 (42)	42

Characteristics	Correct Answer	Responses	n(%)	Awareness score(%)
19. Hormone therapy can protect against bone loss occurring due to menopause.		Incorrect	23 (23)	
		Don't Know	35 (35)	
20. There is no effective treatment for this condition in India	Incorrect	Correct	12 (12)	62
		Incorrect	62 (62)	
		Don't Know	26 (26)	

Highest awareness was recorded for item 1 (osteoporosis causes bone weakness, 92%), item 14 (non-dairy calcium sources, 79%), and item 7 (minor trauma causing fractures in diseased bone, 69%). The lowest awareness scores were seen for item 3 (peak bone mass importance, 17%), item 2 (asymptomatic nature of the disease, 21%), and item 10 (appropriate exercise for bone health, 22%).

Table 4: OKAT-H Knowledge Score Distribution

The majority of women (73%) fell in the moderate knowledge category, 21% scored in the poor knowledge range, and only 6% demonstrated good knowledge of bone health and osteoporosis.

Knowledge Category	Score Range	Percentage of Participants (%)
Poor	0–7	21%
Moderate	8–14	73%
Good	15–20	6%

Table 5: Selected Item-Level Response Analysis (OKAT-H)

Groups	Poor Knowledge Score (0–7)		Moderate Knowledge Score (8–14)		Good Knowledge Score (15–20)		Total	
	n	%	n	%	n	%	n	%
Age Group (years)								
18–30	5	16.7%	22	73.3%	3	10.0%	30	100%
31–40	5	22.7%	17	77.3%	0	0.0%	22	100%
41–50	6	30.0%	13	65.0%	1	5.0%	20	100%
51–60	5	17.9%	21	75.0%	2	7.1%	28	100%
Total	21	21.0%	73	73.0%	6	6.0%	100	100%
Education Level								
Prematriculation	1	100.0%	0	0.0%	0	0.0%	1	100%
SSC	2	25.0%	5	62.5%	1	12.5%	8	100%
HSC	5	41.7%	7	58.3%	0	0.0%	12	100%
Graduate	11	19.0%	45	77.6%	3	3.4%	59	100%
Postgraduate	2	10.0%	16	80.0%	2	10.0%	20	100%
Total	21	21.0%	73	73.0%	6	6.0%	100	100%

VI. DISCUSSION

The findings of this study tell a story that is both understandable and concerning. Women in India know that osteoporosis exists. Many have heard the word, perhaps from a doctor, a television program, or a conversation with an older relative. But knowing that a disease exists and truly understanding how to protect yourself from it are two very different things — and it is precisely this gap that this study brings into focus.

Most participants fell into the moderate knowledge category, meaning they had picked up fragments of information along the way but had never developed a complete or confident understanding of the disease. A smaller but significant number knew very little at all. Very few women demonstrated the kind of thorough knowledge that would actually equip them to take meaningful preventive action. In a country where osteoporosis-related fractures occur a decade earlier than in much of the Western world, and where millions of women are affected, this is not a trivial finding.

The most striking and perhaps most dangerous gap in knowledge was around the silent nature of osteoporosis. Nearly three in five participants believed that pain or some other symptom would warn them before a fracture occurred. In reality, osteoporosis causes no such warning. Bones weaken quietly over years, and for many women, the first sign of the disease is a fracture — often a hip or vertebral fracture with serious, sometimes permanent consequences. When women believe their bodies will alert them to danger, they have little reason to seek screenings, change their diets, or visit a doctor proactively. This single misconception may be responsible for more missed opportunities for prevention than any other.

Equally troubling was the limited awareness around peak bone mass. Only a small fraction of participants understood that the bones built during childhood and adolescence determine the foundation of skeletal health for the rest of a woman's life. The strength accumulated during those early years acts as a kind of reserve — the more that is built, the more can be lost before fractures become likely. Women who do not know this have little reason to prioritize calcium-rich foods or physical activity during youth, and mothers who lack this knowledge may not think to instill these habits in their children. This is a generational gap, not just an individual one, and it quietly shapes the health of future decades.

When it came to understanding who is most at risk, awareness was partial at best. Just over half of participants correctly identified women as more vulnerable to osteoporosis than men. While this represents a slight majority, it also means that a considerable number of women do not fully grasp that their own biology places them at heightened risk — particularly after menopause, when the loss of estrogen causes bone density to decline at an accelerated rate. Many seemed to think of osteoporosis as something that simply happens with old age, affecting everyone more or less equally, rather than understanding the specific and significant way in which a woman's hormonal journey shapes her bones over time. This pattern of partial understanding has been observed in studies across multiple countries and cultures.

Lifestyle-related knowledge was weak across the board. Many women were unaware that smoking damages bone health, or that consuming too much salt can accelerate bone loss. Because these are habits that can be changed, poor awareness here represents a direct missed opportunity. A woman who does not know that smoking is harming her bones has no reason to consider it when thinking about her long-term health. The connection between everyday choices and the slow, invisible process of bone loss is not intuitive, and without clear education, most people will never make it on their own.

The findings around menopause were particularly important given the population studied. Just under half of participants knew that the decade following menopause is a period of rapid and significant bone loss, and fewer than half were aware that hormone therapy, when prescribed appropriately, can help protect against this loss. For women who are approaching or have already passed through menopause — the very group at highest risk — this lack of knowledge can be the difference between timely intervention and years of unaddressed bone deterioration. Previous research among postmenopausal Indian women has reported the same gap, pointing to a consistent failure to reach women with this information at the moment it matters most.⁽⁹⁾

There was also a widespread misunderstanding about physical activity. Most participants appeared to believe that staying active in any form is sufficient to protect bones, when in fact it is specifically weight-bearing and resistance exercises that stimulate bone formation. A woman who walks casually or does light stretching may feel she is doing enough, when in fact the type of movement her bones need is quite different. This false sense of security is subtle but consequential, and it reflects how incomplete health messaging around exercise tends to be.

Not everything in the findings was discouraging. A reassuring majority of participants knew that calcium can be obtained from non-dairy sources like lentils, leafy greens, and fish — important knowledge in a country where many women are lactose intolerant or have limited access to dairy. Most also recognized that Indian women are genuinely at risk of osteoporosis, which pushes back against the cultural assumption that it is a Western problem. And a majority understood that calcium supplements alone cannot prevent the disease, and that effective treatments do exist in India.

These bright spots matter. They represent a genuine foundation — a starting point that health educators and clinicians can build upon rather than starting from scratch. But the overall picture remains one of knowledge that is patchy, incomplete, and in several areas actively misleading. Awareness without understanding creates a false confidence that can be just as harmful as ignorance. What women need is not simply to hear the word osteoporosis more often, but to understand what it actually means for their lives — when it begins, what silently drives it, and what they can concretely do about it at every stage of life. Achieving that requires education that is personal, practical, and persistent — delivered by trusted healthcare providers, embedded in community spaces, and designed to meet women where they already are.

VII. CONCLUSION

This cross-sectional study of 100 women aged 18–60 reveals a concerning pattern of predominantly moderate-to-poor awareness about osteoporosis and bone health. While 92% of participants correctly identified osteoporosis as causing bone weakness, critical knowledge gaps persist in understanding the disease's asymptomatic nature, risk factors such as tobacco and excessive salt consumption, the significance of post-menopausal bone loss, and available treatments including hormone therapy. Out of 100 participants, 73% had moderate knowledge (8–14/20), 21% had poor knowledge (0–7/20), and only 6% demonstrated good knowledge (15–20/20). Educational attainment showed the strongest correlation with knowledge scores. Age showed less impact than expected, suggesting that current health education is not effectively reaching women across the lifespan. These findings underscore the urgent need for targeted, multi-level bone health education programmes integrated into routine clinical care, community settings, and public health campaigns across India.

VIII. CLINICAL IMPLICATIONS

- (1) Early education is crucial because many women are unaware of osteoporosis and bone-health risk factors.
- (2) Bone health counselling should be integrated into routine OPD care, especially for women over 20 and high-risk groups.
- (3) Prevention should be prioritised over treatment, focusing on lifestyle changes before fractures occur.
- (4) Community-based awareness programmes are needed to reach women outside hospitals, especially in rural and low-education settings.
- (5) Early screening and risk assessment should be promoted to identify high-risk women before significant bone loss occurs.

IX. LIMITATIONS AND SUGGESTIONS

Convenience sampling may limit generalisability to the wider population. The cross-sectional design precludes measurement of change over time. Awareness and behaviours were self-reported and not objectively verified (no biochemical or BMD confirmation). The wide age band (18–60) encompasses very different life stages that may require sub-group analysis. Future studies should use stratified sampling by age group and urban/rural setting, include objective markers such as DXA or serum vitamin D levels for a subsample, and evaluate the effectiveness of targeted educational interventions on actual bone health outcomes.

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