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Research Article

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Assessment of Knowledge and Risk Factors of Osteoporosis Among the Adult and Elderly

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Abstract: A bone-healthy lifestyle is essential for everyone, like babies, children, teenagers, and young adults, and is particularly important for patients with osteoporosis, the most common skeletal disorder characterized by low bone mass and structural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture. Low bone mass and skeletal fragility in adults may be due to low peak bone mass in early adulthood, excessive bone loss in later life, or both. Even though osteoporosis is a preventable disease, its high prevalence has resulted in massive morbidity, mortality, and decreased quality of life due to a lack of disease knowledge and awareness among the general public. Evidence based on other disorders shows that learning about the disease can help in early recognition and information about risk factors leads to prevention through lifestyle and behaviour modifications. A six-month cross-sectional study was performed with the objective of assessing the knowledge of osteoporosis, identifying the risk factors and exploring the association between sociodemographic factors and knowledge levels of osteoporosis among adults and the elderly by using the Revised Osteoporosis Knowledge Test. Participants were categorized into different socioeconomic classes by using the Kuppuswamy scale. In our study, from a total of 553 participants' responses, 217 (39.24%) were men, and 336 (60.75%) were women, with no significant variation in mean age distribution. Most participants belong to the upper-middle-class category, with a comparatively high percentage of women, followed by the lower-middle-class sort. The knowledge and understanding of osteoporosis and its contributory risk factors are poor among current study participants, which stresses the need to improve understanding among men and women through awareness programs, mainly targeting the low socioeconomic category populations.

Keywords: Bone Healthy Lifestyle, Bone Mineral Density, Osteoporosis Knowledge Test and Socioeconomic.

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1. INTRODUCTION

Osteoporosis, or "the silent disorder" is a commonly known skeletal disorder characterised by low bone mass and structural deterioration of bone tissue, along with a consequent increase in bone fragility and vulnerability to fracture. Despite its commonness, only one in three patients with osteoporosis are diagnosed, and only one in seven gets treatment. Low bone mass and increased brittleness are attributable to low peak bone mass in early adulthood excess bone loss in later life, or both. Approximately 70-80% of peak bone mass is genetically determined. The residual is contributed by many non-genetic elements such as nutrition, load-bearing activities, and hormones concerned with growth and puberty. A bone-healthy lifestyle (consisting of enough nutritional calcium and vitamin D, exercise, avoiding tobacco, and so forth) is vital for everyone, including sufferers with osteoporosis [1-3]. Worldwide, annually, osteoporosis causes more than 8.9 million fractures and results in an osteoporotic fracture every three seconds [2]. The World Health Organization (WHO) scientific group on the evaluation of osteoporosis at the primary health care level shows that osteoporosis is a serious health risk for both males and females. It is envisioned to have an effect on 200 million women worldwide, an approximately multifold increase from 60 to 90 years of age [4]. By the year 2050, the global incidence of hip fractures is projected to boom by 310% and 240% in males and females, respectively [5]. In Asia, osteoporosis is significantly underdiagnosed and undertreated, even in most high-risk patients with fracture histories. The hassle is mainly acute in rural areas. In the most populous nations, like China and India, the majority of the populace lives in rural areas, where hip fractures are usually treated at home rather than by surgical therapy in hospitals. Dual Energy X-ray Absorptiometry (DXA) technology is relatively costly and isn't extensively available in most growing Asian nations, specifically in rural areas [6]. Nearly all Asian countries fall far below the WHO recommendations for calcium consumption [6,7]. Vitamin D deficiency during childhood and adolescence decreases peak bone mass in adults and increases osteoporosis risk. Studies from South and Southeast Asian countries confirmed the widespread hypovitaminosis D in each sex and all age groups of the population [8], which is projected to make up more than 51% of all osteoporotic hip fractures in Asia by the year 2050 [5,9]. Nutritionally, the Indian population typically consumes much less calcium than the ideal daily intake, which contributes to the rising prevalence of osteoporosis as well as lower bone mineral density values than values stated in developed nations[10]. The United Nations (UN) projects that India's population will be 1.64 billion by 2050, and the Institute of Health Metrics and Evaluation (IHME) projects 1.61 billion by 2048 [11]. A 14-16% increase in population size and an increased lifetime risk for osteoporotic fractures in both sexes increase the chances of osteoporosis in the coming future [12,13]. Despite osteoporosis being a preventable disease, its high prevalence has resulted in massive morbidity, mortality, and decreased quality of life due to a lack of disease knowledge and awareness among the general public [14-16]. Evidence-based on other disorders shows that learning about the disease can aid in early recognition and information about risk factors leads to prevention through lifestyle and behaviour modifications. There are various tools available to evaluate knowledge of osteoporosis. In this study, the recently revised Osteoporosis Knowledge Test (Revised OKT; 2012) [17] was used to evaluate the extent of knowledge of osteoporosis in Indian adults and the elderly. The study aimed to assess knowledge about osteoporosis, identify risk factors and examine the association between sociodemographic factors and the level of knowledge about osteoporosis in adults and the elderly by using the Revised Osteoporosis Knowledge Test.

2. MATERIALS AND METHODS

A cross-sectional study of six months' duration was conducted at the secondary care referral hospital with ethical approval from the institutional review board (RIPER/IRB/PP/2020/006).

2.1. Study Tools

Patient documentation form includes demographic information, medical, medication and social histories, and any relevant family histories. Socioeconomic Status: Kuppuswamy Socioeconomic scale is a tool to measure an individual's or family's economic and social position by analysing variables like income, education, occupation, etc[18]. Revised Osteoporosis Knowledge Test-OKT (Revised-OKT 2012): [17] The Knowledge Assessment Questionnaire consists of 32 questions related to the nutrition, exercise, and risk factors for osteoporosis as subscales. Written approval was obtained from the original author (Phyllis Gendler et al.) and necessary changes were made to improve its applicability to the South Indian population with author guidance.

2.2. Study Criteria

2.2.1. Inclusion Criteria

Subjects aged 18 years and above of both the genders, with or without comorbidities, willing to participate were included into the study.

2.2.2. Exclusion Criteria

Pregnant women, breast feed women were excluded from the study.

2.3. Sample Size

A convenience sample of 553 adults and elderly were recruited from the individuals attending the secondary care referral hospital.

2.4. Study Procedure

Initially, participant data was collected with their consent to participate in the study through a patient documentation form that included demographic (name, age, and sex) and socioeconomic details. And further, Revised Osteoporosis Knowledge Test (OKT) questionnaire was supplied to record the responses and the same were assessed to define the participant's knowledge levels, and risk factors for osteoporosis. The Socioeconomic Status (SES) of participants was computed and categorized by means of the Kuppuswamy Socioeconomic Scale and the relation between socioeconomic status, and osteoporosis knowledge was assessed.

2.5. Data Collection, Management and Analysis

All individuals who consented to participate in the study were interviewed to obtain the required data using predefined structured data collection form. Subsequently, the revised osteoporosis knowledge test questionnaire was supplied,

ensuring complete confidentiality and anonymity of their responses. The questionnaire included 32 items in two subscales: OKT-exercise, 20 items, and OKT-nutrition, 26 items. The two scales share 14 common items which measure an individual's knowledge of risk factors, treatment and screening tests for osteoporosis. In the list of 36 items, the first eleven items are statements with four choices that may or may not affect a person's chance of getting osteoporosis. The remaining items are multiple-choice questions with four choices. All correct answers were scored 1, while all incorrect or "don't know" responses were scored 0. The OKT-total score ranged from 0 to 32, the OKT-exercise subscale score ranged from 0 to 20, the OKT-nutrition subscale score ranged from 0 to 26, and the OKT-risk factor subscale score ranged from 0 to 14.

2.6. Statistical Analysis

The responses to the questionnaire were verified and entered into a Microsoft Excel spreadsheet, and the variables were described in terms of frequencies, percentages, mean, and standard deviations. Osteoporosis knowledge scores were defined for the participants based on their responses. A Chi-square test was used to check the significance between the variables ($P \leq 0.05$), for which GraphPad Prism 9.1.0 was used.

3. RESULTS

3.1. Characteristics of The Study Participants

There were 553 responses from participants, with 21 (39.24%) men and 336 (60.75%) women, with no discernible variance in the mean age distribution. The findings are shown in Table 1.

Table 1: Demographic details of study participants.

Variable	Gender		Total (%)
	Men (%)	Women (%)	
Gender	217 (39.24)	336 (60.75)	553
Age (Years)			
18-39 (Young adult)	154 (70.96)	202 (60.11)	356 (64.37)
40-59 (Adult)	50 (23.04)	125 (37.20)	175 (31.64)
60-69 (Elder)	10 (4.60)	5 (1.48)	15 (2.71)
70-79 (Elderly)	2 (0.92)	3 (0.89)	5 (0.90)
80-89 (Old)	1 (0.46)	1 (0.29)	2 (0.36)
BMI			
<16 (Severe Thinness)	1 (0.46)	7 (2.08)	8 (1.44)
16-17 (Moderate Thinness)	4 (1.84)	5 (1.48)	9 (1.62)
17-18.5 (Mild Thinness)	7 (3.22)	13 (3.86)	20 (3.61)
18.5-25 (Normal)	107 (49.30)	166 (49.40)	273 (49.36)
25-30 (Overweight)	68 (31.33)	105 (31.25)	173 (31.28)
30-35 (Obese Class I)	26 (11.98)	33 (9.82)	59 (10.66)
35-40 (Obese Class II)	3 (1.38)	4 (1.19)	7 (1.26)
>40 (Obese Class III)	1 (0.46)	2 (0.59)	4 (0.72)
Nativity			
Rural	97 (44.70)	165 (49.10)	262 (47.37)
Urban	120 (55.29)	171 (50.89)	291 (52.62)
Education			
Profession/Honors	1 (0.46)	3 (0.89)	4 (0.72)
Graduate or Postgraduate	157 (72.35)	242 (72.02)	399 (72.15)
Intermediate	21 (9.67)	50 (14.88)	71 (12.83)
High School	18 (8.29)	22 (6.54)	40 (7.23)
Middle School	8 (3.68)	3 (0.89)	11 (1.98)
Primary School	6 (2.76)	6 (1.78)	12 (2.16)
Illiterate	6 (2.76)	10 (2.97)	16 (2.89)
Marital Status			
Married	132 (60.82)	234 (69.64)	366 (66.18)
Unmarried	85 (39.17)	102 (30.37)	187 (33.81)
Occupation			
Profession	91 (41.93)	92 (16.63)	183 (33.09)
Semi profession	111 (20.07)	14 (2.53)	25 (4.52)
Clerical/Shop owner	13 (5.99)	16 (2.89)	29 (5.25)
Skilled worker	5 (2.30)	1 (0.18)	6 (1.08)
Semiskilled worker	11 (5.06)	2 (0.36)	13 (2.35)
Unskilled worker	1 (0.46)	0 (0)	1 (0.18)
Unemployed	68 (31.33)	198 (35.86)	266 (48.18)

The participant's medical, medication histories and family medical histories revealed that a total of 66 (11.93%) participants had a family history of osteoporosis. In addition, hypertension and diabetes were the most prevalent comorbidities among the study participants. And also, respiratory illnesses like asthma and thyroid disorders were prevalent next to hypertension and diabetes.

3.2. Osteoporosis Knowledge Test Responses

3.2.1. Risk Factors, Diagnosis and Treatment for Osteoporosis

Significantly more women than men correctly identified risk factors for osteoporosis, like a diet low in dairy products, being in menopause, having a positive family history, having surgical removal of the ovaries and being obese. Comparatively fewer correct responses were obtained for factors like white or Asian women who were overweight. Risk factors like smoking and alcohol consumption failed to attract as many correct responses as women, though these social habits were more prevalent in men than women, unlike western practices. Half of the participants incorrectly identified childhood as the time for bone growth. In contrast, more than 50% of men and women identified dual x-ray absorptiometry as the primary diagnostic test for osteoporosis. More than 60% of men and women correctly identified the significance of therapy once osteoporosis is detected in a person.

3.2.2. Knowledge of The Importance of Exercise

More than half of the participants has recognised the significance of exercising for at least 30 minutes per day, five days per week, and barely 30-40% of participants identified the activities promoting bone health, while comparatively a smaller number of participants recognised weight lifting as a beneficial activity in preventing osteoporosis.

3.2.3. Knowledge of The Importance of Calcium and Vitamin D

A higher percentage (76%) of women correctly identified sources of calcium than men. However, most participants (72%) did not recognise ice cream as a source of calcium. Only 31% of men and 37.5% of women could correctly identify the appropriate amount of calcium intake for adults. In comparison, 60% of men and 57% of women responded correctly to taking calcium supplements. A higher percentage of women compared with men identified vitamin D as required for calcium absorption and sunlight as the best source for vitamin D. Few participants were able to identify the optimal food sources of vitamin D for calcium absorption. Both men and women gave poor answers about the necessary daily allowance of vitamin D.

Table 2: Participant Characteristics relative to Osteoporosis Risk

Variable	Knowledge		Total (%)	P value
	Low (<60%)	High (>80%)		
	464	17	481	
Age				
18-39 (Young adult)	311 (64.65)	12 (2.49)	323 (67.15)	0.5456
40-59 (Adult)	139 (28.89)	5 (1.03)	144 (29.93)	
60-69 (Elder)	13 (2.702)	0 (0)	13 (2.7)	
70-79 (Elderly)	0 (0)	0 (0)	0 (0)	
80-89 (Old)	1 (0.2)	0 (0)	1 (0.2)	
BMI				
<16 (Severe Thinness)	7 (1.45)	1 (0.2)	8 (1.66)	0.0001*
16-17 (Moderate Thinness)	6 (1.24)	1 (0.2)	7 (1.45)	
17-18.5 (Mild Thinness)	18 (3.74)	0 (0)	18 (3.74)	
18.5-25 (Normal)	230 (47.81)	7 (1.45)	237 (49.27)	
25-30 (Overweight)	146 (30.35)	6 (1.24)	152 (31.6)	
30-35 (Obese Class I)	51 (10.60)	1 (0.2)	52 (10.81)	
35-40 (Obese Class II)	5 (1.03)	1 (0.2)	6 (1.24)	
>40 (Obese Class III)	3 (0.6)	0 (0)	3 (0.62)	
Nativity				
Rural	229 (47.60)	6 (1.24)	235 (48.85)	0.2727
Urban	240 (49.89)	11 (2.28)	251 (52.18)	
Education				
Profession/Honors	3 (0.62)	1 (0.2)	4 (0.83)	0.2685
Graduate or Postgraduate	333 (69.23)	14 (2.91)	347 (72.14)	
Intermediate	62 (12.88)	1 (0.2)	63 (13.09)	
High School	33 (6.86)	1 (0.2)	34 (7.06)	
Middle School	10 (2.07)	0 (0)	10 (2.07)	
Primary School	8 (1.66)	0 (0)	8 (1.66)	
Illiterate	15 (3.11)	0 (0)	15 (3.11)	
Marital Status				
Married	299 (62.16)	10 (2.07)	309 (64.24)	0.6351
Unmarried	165 (34.3)	7 (1.45)	172 (35.75)	
Occupation				
Profession	32 (6.65)	2 (0.41)	34 (7.06)	
Semi profession	66 (13.72)	3 (0.62)	69 (14.34)	
Clerical/Shop owner	103 (21.41)	6 (1.24)	109 (22.66)	

Skilled worker	5 (1.03)	0 (0)	5 (1.03)	0.9198
Semiskilled worker	12 (2.49)	0 (0)	12 (2.49)	
Unskilled worker	18 (3.74)	1 (0.2)	19 (3.95)	
Unemployed	130 (27.02)	4 (0.83)	134 (27.85)	
Physical Activity				
Yes	126 (26.19)	6 (1.24)	132 (27.44)	0.4601
No	338 (70.27)	11 (2.28)	349 (72.55)	

Table 2 presents the knowledge levels (low and high) in relation to participants' characteristics. 64.65% of young adults had a low level of knowledge, followed by the adult age group. Poor OKT scores were reported by both rural and urban residents, with 47.6% and 49.8%, respectively. 69.23% of the graduate and postgraduate participants reported a low level of knowledge, whereas 3% of the same group had high knowledge scores. In terms of occupation, the unemployed had lowest OKT scores (27%), followed by clerical/shop owners (21%), and semi-profession (13%). 26% of the participants doing physical activity reported low OKT scores, along with 70% of the participants who said no for the same.

Table 3: OKT and Subscale median comparison

Scores*	Men	Women
OKT Total	14	15
OKT-Exercise	8	8
OKT-Nutrition	12	12
OKT-Risk factors	6	6

P Value >0.05

Of the maximum achievable scores, the reduced median OKT-total, OKT-exercise, and OKT- nutrition scores, as well as the OKT-risk factors score in men, and women reflect poor knowledge of osteoporosis.

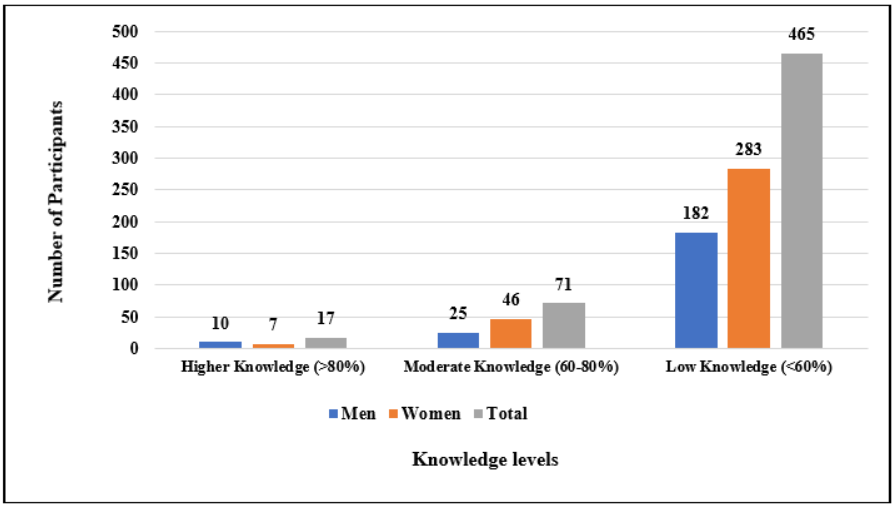

Fig 1: Revised OKT-based Osteoporosis knowledge assessment

It was found that over 80% of participants had low knowledge with minimal gender variation, and 3.07% and 12.83% of participants had higher and moderate knowledge levels for osteoporosis, respectively.

Table 4: Comparison of OKT Knowledge levels and socioeconomic status

Socioeconomic Category	High Knowledge (>80%)		Moderate Knowledge (60-80%)		Low Knowledge (<60%)	
	Men	Women	Men	Women	Men	Women
Upper	1	1	2	5	14	13
Upper middle	8	6	18	36	113	228
Lower middle	0	0	4	4	20	28
Upper lower	1	0	1	1	15	11
Lower	0	0	0	0	0	2

3.2.4. Knowledge of Osteoporosis in Comparison with Socioeconomic Status

In our study, most participants belong to the upper-middle-class category with a comparatively high percentage of women, followed by the lower middle-class socioeconomic category with low knowledge scores. However, irrespective of knowledge levels, 73% of participants, both men and women, fit into the upper-middle-class category.

4. DISCUSSION

Osteoporosis knowledge levels indicate that a significant portion of participants in the study had inadequate knowledge about osteoporosis, and only 2.1 to 4.6% showed acceptable knowledge levels, with more than 80% correct responses. Similar types of results were reported about osteoporosis knowledge by Palaclous et al., (2009), Doheny et al., (2007), and Kadam et al., (2018) [19]. The results indicate that the people falling in the age group of 18-39 have low levels of knowledge about osteoporosis and make up the majority (67%) of the total participants, whereas in a study by Kadam et al., (2018), it showed that people over 40 years had low knowledge levels in the majority [19]. In our study, both men and women did not show any significance in between level of knowledge of osteoporosis and level of education, whereas in other studies it was shown that there was a level of significance between knowledge of osteoporosis and education like Etemadifir et al., (2013), Shawa et al., (2011), and some other studies like Yeap et al., (2010), and El-Tawab et al., (2015), observed that a higher socioeconomic level of educated and working women was associated with easier and more access to quality health information [20-23]. This study demonstrates significance in the relationship between the participant's level of knowledge and BMI. The current study shows that 39.2% of women and 46.5% of men correctly identified smoking as a risk factor, whereas men had a 38% correct response in Shawa et al., (2011), and women had 19.1%, 53.4%, and 52.6% correct responses in Alexandraki et al., (2008), El-Tawab et al., (2015), and Ungan et al., (2001), respectively [21, 23-25]. According to Yeap et al., (2010), 27.6% of women were unaware that smoking was a risk factor [20]. This study observes that 35.4% of men and 29.7% of women identifies alcohol as a risk factor, whereas men in Shawa et al., (2011), and women in Yeap et al., (2010), have 35% and 27.6% respectively [20,21]. There is growing evidence that women who know their bone mineral density is low, those who are educated about osteoporosis, or both, are more likely to follow clinical recommendations and adopt osteoporosis protective behaviours. It is reported that 36.8% of men and 34.8% of women believe that family history of osteoporosis is a risk factor whereas women in El-Tawab et al., (2015), Ungan et al., (2001), Alexandraki et al., (2008), and men in Shawa et al., (2011), have 32.3%, 57%, 12.8%, and 72%, respectively [21, 23-25]. And 67.4% and 34% of women from Ungan et al., (2001), and Alexandraki et al., (2008), reported menopause as a risk factor that can affect osteoporosis, whereas in our study, 58.6% of women reported menopause as a risk factor [24,25]. In a systematic review on older men's knowledge of osteoporosis, Gaines and Marx (2010) et al., found men have less knowledge than women in understanding the relationship between osteoporosis and men's health, whereas our study found no difference between men and women [26]. As a result, it is imperative to adopt bone-healthy lifestyle practises in order to avoid or reduce the risk of developing osteoporosis. This could be archived through promotional campaigns and awareness activities aimed not only at post-menopausal women but also at all adult and elderly age groups, and will aid in enhancing bone-healthy lifestyle knowledge and practice to avoid and prevent osteoporotic fractures.

5. LIMITATIONS

As this study investigated knowledge of osteoporosis and risk factors among adults and the elderly, the findings are confined to young adult populations at large. The applicability of the study is also limited, as it was an observational cross-sectional study of a small group attending a rural secondary healthcare setting and this study only provided knowledge of osteoporosis in relation to bone-healthy lifestyle and risk factors at the latter part of the participant's lives. However, further longitudinal studies among large populations of different sociodemographic backgrounds are required to verify and examine the osteoporosis knowledge levels, practice, and its impact on osteoporosis preventive behaviours.

6. CONCLUSION

The results of this study showed that most of the participants in the current study had a low level of knowledge about osteoporosis and its risk factors, with no differences in terms of gender, age group, education, and occupation, or socioeconomic characteristics. The majority of young adults of both sexes are unaware of osteoporosis due to a lack of knowledge and poor application of preventive measures. This underscores the need to improve knowledge of osteoporosis in both men and women through comprehensive community-based health education programs and screening, specifically targeting populations of low socioeconomic status. Further research aiming to build and guide future modalities for communicating knowledge about preventive measures should examine perceptions in a larger sample of the general population and at-risk population to increase their awareness of osteoporosis and motivate healthy behaviors. Healthcare professionals can play an important role in planning appropriate health education intervention strategies.

7. ACKNOWLEDGEMENT

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8. AUTHORS CONTRIBUTION STATEMENT

Dr Uppara Veerendra conceptualized and designed the study and L Deepthi Reddy, Medha Elizebeth Mathews gathered the data. L Deepthi Reddy and G Vyshnavi discussed the methodology and analysis. Dr Uppara Veerendra and Medha Elizebeth Mathews analysed the data and all the authors discussed the methodology and results and contributed to the final manuscript.

9. CONFLICT OF INTEREST

Conflict of interest declared none.

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