ORIGINAL ARTICLE

Assessment of Awareness of Osteoporosis Amongst Unmarried Indian Girl Students Pursuing Undergraduate and Postgraduate Professional Courses

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ABSTRACT

Background: Osteoporosis is a silently progressing metabolic bone disease also known to result in bone loss in alveolar processes of maxilla and mandible that provide bony framework for tooth anchorage. Osteoporotic fractures usually occur 10–20 years earlier in Indians than Caucasians. But relatively little is known about risk factors in women in Indian subcontinent. This is the first study to assess awareness of osteoporosis among unmarried Indian girl students pursuing undergraduate and postgraduate professional courses in the city.

Materials & Methods: A 25-item multiple-choice-cum-fill-in-blank-type 'Osteoporosis Awareness Questionnaire' (OAQ) was developed keeping in mind healthy participants and not patients. With '*No idea*' as an option, volunteers had liberty to make honest decisions and avoid forceful selections/speculations.

Results: OAQ was effective in assessing students' awareness, causes, risk factors, consequences, diagnosis and measures for prevention and management of osteoporosis. Findings demonstrate low level of osteoporosis awareness among young Indian girl students. Univariate logistic regression analysis revealed that undergraduate students had 1.26-fold lower awareness level and were likely to be at 1.31-times greater risk of osteoporosis than postgraduates.

Conclusion: Persisting gap in health knowledge and practices among young girls and masses can be reduced through education and healthy behavior to enable them to timely diagnose and manage this debilitating disease to lead better quality of life while ageing.

Keywords: Osteoporosis, awareness, Questionnaire, unmarried girl students, India

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INTRODUCTION

Osteoporosis is one of the most common silently progressing metabolic bone disease[1] affecting one in three women and one in twelve men at some point in their lives.[2] In women, this process is accelerated during peri-menopausal period with up to 85% increase in bone resorption rate.[3] In men, low testosterone levels have been linked to osteoporosis.[4] Pertinently, the condition of osteoporosis is well known to result in bone loss in alveolar processes of the maxilla and mandible that provide bony framework for tooth anchorage and may lead to tooth loss, increased vulnerability of alveolar bone to functional loads transferred through removable and fixed prostheses including implants, and dysfunction and pathogenic fracture of the temporo-mandibular joint especially in the geriatric patients.[5] World Health Organisation has estimated that 30% of all women above 50 years of age suffer from osteoporosis based on definition of Bone Mineral Density (BMD) being <2.5 standard deviation below the mean bone mass of normal young adult reference population.[6,7]

Osteoporosis is widely prevalent in India and osteoporotic fractures are common cause of morbidity and mortality in adult Indian women and men.[8] Experts peg osteoporosis patients in India at approximately 26 million with numbers

projected to increase to 36 million by 2013.[9] Although relatively little is known about risk factors in women in Indian subcontinent, osteoporotic fractures usually occur 10–20 years earlier in Indian women and men than western Caucasians.[10] It has also been suggested that osteopenia and osteoporosis may occur at relatively younger age in Indian population.[7,11,12]

Awareness of various aspects of a disease is one of the foremost pre-requisites for its effective prevention and management. This also provides to an individual the power of making decision about health practices. According to a recent study,[13] correct knowledge about osteoporosis increases possibility of appropriate compliance with prescribed treatment, thus reducing risk of osteoporotic fractures. Education programs for osteoporosis awareness are, therefore, necessary and should comprise of primary measures aimed at improving peak bone mass during period of growth and development and secondary measures aimed at preserving bone mass later in life. Previous studies have reported wide gaps in awareness regarding osteoporosis prevention and treatment among Indian men, women and professionals. Pande et al.[14] who developed a 20-item multiple-choice questionnaire to assess patients' knowledge about osteoporosis, have stressed the need for educational intervention as part of osteoporosis management program. Other such studies on Indian population, too, have emphasized the need to expand research on knowledge about osteoporosis to increase its impact on disease prevention and early diagnosis in general population[15] and especially among nurses, who despite being fully aware of their important role in educating public on osteoporosis prevention and management, had only moderate knowledge on signs of the disease, medication and lifestyle issues, and appeared confident only about advising on fall prevention.[16]

To initiate any educational program it is most important to assess current level of knowledge. Present study was aimed to assess awareness of osteoporosis among unmarried Indian girl students pursuing undergraduate and postgraduate professional courses in the city. To the best of our knowledge this might be the first study on assessment of awareness of osteoporosis among girl students in India.

MATERIALS AND METHODS

An 'Osteoporosis Awareness Questionnaire' (OAQ; available with the authors) was developed to effectively measure awareness of osteoporosis among unmarried girl students (18-24 years of age) pursuing undergraduate (Bachelor of Technology; B.Tech.; 18.80±1.31 mean ± SD years) and postgraduate (Master of Business Administration; MBA; 21.84±1.30 mean ± SD years) courses in the city. The Questionnaire was developed keeping in mind normal healthy participants and not the patients. The OAQ consisted of 23 multiple-choice and 2 fill-in-the-blank type questions distributed to construct four groups viz. (a) General knowledge including understanding of the disease and its causes, (b) Risk factors, (c) Consequences and (d) Measures for its prevention and management. The questions were related to definition of osteoporosis, age of peak bone mass, age when osteoporosis is most prevalent, hormones whose deficiency causes osteoporosis in women and men, most reliable method of its diagnosis, recommended daily intake of calcium, role of vitamin D, adequate requirement of sun exposure, non-pharmacological and pharmacological methods for prevention and management and their source of awareness of the disease.

Questionnaire was randomly administered to 100 girl students each from Engineering and Management streams belonging to five different Technology and Management Colleges in the city. Informed consent was obtained from participants before filling the Questionnaire. Participants had the right to opt out of this study at any time without having to give any reason to do so. Identity of the participants has been kept confidential. None of the students refused to participate. Participants were explained the objective of the Questionnaire, correct method of entering their response and scoring criteria. Participants were given 30 minutes time to respond to the Questionnaire. With introduction of '*No idea*' as an option in each question, volunteers were provided liberty to make honest decisions and avoid forceful selection or speculation to any query. To avoid group bias, they were asked to answer the Questionnaire individually. Each correct answer was awarded +1 score. Each wrong answer was awarded -1 score. Questions left unanswered or marked '*No idea*' received zero score. Awareness score ranged between -12 and +23. A pilot study on 20 students helped to rectify missing information and define intricacies for effective administration of the Questionnaire. Awareness scores obtained by the two streams (i.e., B.Tech. and MBA) of students were compared by Student's 't' test. Multiple logistic regression analysis was done to obtain odds in the knowledge of osteoporosis prevention. Logistic regression was used to differentiate knowledge of the two streams of students. The study was approved by the institutional review board.

RESULTS

Awareness level

Amongst the two options, the definition of osteoporosis characterized only by porous bones resulting in decreased bone mass was marked by 29% students. Eighteen percent students marked the second option defining osteoporosis as the condition where bone resorption outpaces bone formation. Forty four percent students marked both these options as correct. Only a small number of students, 9%

had '*No idea*' of the changes occurring in the bone during osteoporosis.

That osteoporosis is a bone-related disease was known to majority (88%) participants. While 6% reported that it was a disease either of liver, kidney, brain or heart, the remaining 6% were honest enough to mark '*No idea*'.

Osteoporosis primarily affects women was answered by 74% participants. Only 6% responded that it affects men more than women. It primarily affects children was answered by 7% students, while remaining 13% student had '*No idea*' in this respect.

In the opinion of 42% students, osteoporosis was responsible for bone fractures. That osteoporosis caused loss of height was mentioned by 13% students. Two percent participants responded to the fact that this disease caused hunched back. A total of 34% participants were aware that osteoporosis could cause all these deformities of the body. Remaining (9%) students had '*No idea*'.

While 24% of responders mentioned that osteoporosis affected whites more than blacks as against 4% who mentioned that it affected blacks more. However, 32% felt that osteoporosis equally affects both whites and blacks. Majority (40%) of the students were honest in responding that they had '*No idea*' in this respect.

Assessing awareness of students about age of peak bone mass, 52% responded that it occurred between 22-27 years of age, while 30% were of the opinion that it was between 15-18 years of age. While 9% mentioned it to be between 33-38 years of age, 3% stated that maximum bone strength occurs after 35 years of age. Remaining 6% had '*No idea*' about age of peak bone mass.

Regarding age at which osteoporosis was most prevalent, 21% responded that it was most common after 50 years of age. While 19% responded it to be between 35-40 years and 50% between 45-50 years of age, 10% students had '*No* idea' about this fact.

Only 65% students were aware that Vitamin D deficiency causes osteoporosis. Role of sunlight in vitamin D synthesis was known to 76% students. Others were either incorrect (17%) or had '*No idea*' (7%) in this regard. That exposure to sun for about twenty minutes daily helped to prevent osteoporosis was stated by 68% students. Eighteen percent were of the opinion that one should stay in sun for 2 hours and 2% for 4 hours every day. In contrast, 5% responded that one should not get exposed to sun at all if one wants to prevent osteoporosis. Seven percent responders had '*No idea*' about this fact.

Knowledge of measures for prevention of osteoporosis was assessed by four questions. Sixty five percent responders mentioned that adequate exposure to sun was major factor for prevention of osteoporosis. Adequate diet and exercises can prevent osteoporosis was stated by 78% participants. That osteoporosis can be prevented by pharmacological methods was known to 45% responders, while 35% marked that it can be prevented by hormone therapy.

More than half (54%) of the students were aware that osteoporosis affected teeth in addition to bones. Twenty nine percent students responded that osteoporosis did not affect teeth, while remaining 17% had '*No idea*' about this.

Distribution of responses for daily calcium intake in post-menopausal women varied between 500 (35%), 1200 (32%) and 2500 (5%) mg, whereas 28% responders had '*No idea*' about daily requirement of calcium by normal adults. In reply to question on recommended dose of calcium for adults below 50 years of age, 23% reported 800 mg, 26% reported 1000 mg where as 19% answered it to be 1200 mg, while 32% had '*No idea*' about this.

Correlation between hormone levels and osteoporosis was assessed through two questions where students were to choose between low or high circulating level of estrogen in female and androgen in male that caused osteoporosis. That low level of estrogen in females and androgen in males caused osteoporosis was known to 61% and 36% students, respectively. However, fairly high number of students (22% and 30%, respectively) had '*No idea*' about relationship of estrogen or androgen with osteoporosis. That high estrogen (17%) and high androgen (34%) levels was a common cause of osteoporosis was wrongly reported.

In response to query on method by which osteoporosis can be easily diagnosed, 43% students were aware that it could be diagnosed by BMD measurement. Surprisingly, an almost equal number (41%) had '*No idea*' about this fact. While 16% had false idea that it can be diagnosed through use of stethoscope or X-ray of chest.

Six options were provided to assess their source of awareness about osteoporosis. Marking single choice of their awareness, 32% stated that they came to know about it from friends, 24% from physician and 21% from magazines and newspapers. Only 5% students mentioned that they came to know about osteoporosis when one such case occurred in the family. More than one sources of awareness of osteoporosis (viz., newspaper, magazine, television, friend, teacher, physician, occurrence in family) was identified by 18% students.

Awareness score

Sub-group wise summary of awareness of osteoporosis has been shown (Table 1). On comparing mean scores, a significant difference ($P<0.05$) was observed in General

Table 1. Summary of awareness scores of B.Tech. and MBA girl students regarding osteoporosis

Sub-group	Awareness scores						t-Value
	B.Tech. students			MBA students			
	Mean ± SD	Minimum	Maximum	Mean ± SD	Minimum	Maximum	
General knowledge	3.06±2.57	-2	9	4.64±2.93	-1	9	2.87*
Risk factors	0.58±1.55	-2	4	0.26±1.23	-2	3	1.14
Consequences	1.64±1.06	0	3	1.54±1.05	0	3	0.47
Prevention	2.28±1.75	-1	6	2.44±1.31	0	6	0.52
Total score	8.68±4.34	-1	20	9.92±3.80	+3	17	1.52

B.Tech.: Bachelor of Technology
MBA: Master of Business Administration
*P<0.05; B.Tech. *versus* MBA students
All other relevant comparisons were statistically non-significant (P>0.05)

Knowledge about osteoporosis between B.Tech. and MBA students. Awareness score of MBA students was more than that of B.Tech. students. Average awareness score regarding risk factors, consequences and measures for prevention and management were not significantly (P>0.05) different between undergraduate and postgraduate students.

Logistic regression analysis

Results of univariate logistic regression analysis of each sub-group (Table 2) revealed that low General knowledge appeared to be a significant risk factor for awareness of osteoporosis among undergraduate students. Undergraduate students had 1.26-fold lower awareness level as compared to the postgraduate students. B.Tech. students are, therefore, likely to be at 1.31-times greater risk of osteoporosis than MBA students. Multiple logistic regression analysis demonstrated that overall knowledge about students to sunlight being adequate to prevent osteoporosis and low level of estrogen promoted osteoporosis constitutes an important sub-set of questions for awareness of osteoporosis among undergraduate girls.

Table 2. Logistic regression analysis

Sub-group	Constant	Coefficient ± SEM	Z-score	Likeli-hood	Odds ratio	95% Confidence interval	
						Lower	Upper
General knowledge	+0.926	-0.231±0.084	2.74*	8.257	0.794	0.673	0.936
Risk factors	-0.248	+0.269±0.161	1.67	2.952	1.309	0.955	1.794
Consequences	-0.144	+0.091±0.191	0.48	0.227	1.095	0.753	1.592
Prevention	+0.078	-0.041±0.134	0.31	0.095	0.960	0.738	1.248
Total score	+0.061	-0.067±0.052	1.30	1.717	0.935	0.845	1.035

*P<0.05; B.Tech. *versus* MBA students
All other relevant comparisons were statistically non-significant (P>0.05)

DISCUSSION

Results of this study demonstrate low level of awareness among young Indian population and suggest urgent need to ensure awareness to the masses through education programs to enable them to timely diagnose and manage this debilitating disease and lead a better quality of life while ageing. These findings also stress the need to expand research efforts assessing knowledge among physicians, nurses and paramedical staff to facilitate development of targeted educational programs on the disease, its prevention and management.

It is now well established that osteoporosis is not a reversible disease and bone lost due to increased osteoclastic resorption after menopause or other estrogen-deficiency states (such as ovarian dysgenesis/dysfunction, hyperprolactinemia, bilateral ovariectomy, estrogen receptor abnormality in target tissues, aromatase deficiency or prolonged exogenous treatment with gonadotrophin releasing hormone agonists/ antagonists or aromatase inhibitors) in women or during ageing in both women and men cannot be fully recovered. Pertinently, however, this disease is preventable by timely interventions such as improved nutrition, exercise, adequate exposure to sunlight, healthy lifestyle, fall preventions and certain pharmacological interventions. It is now well recognized that general awareness of a disease is one of the foremost pre-requisites for its effective prevention and management. This also provides to an individual the power of making decision about future health practices. Internationally, studies conducted on healthy as well as osteoporotic subjects have found low to moderate scores on knowledge scale assessing various aspects of the disease.[15] Various small scale surveys conducted in India, too, indicate awareness of osteoporosis in Indian urban population to be only about 10-15% (www.isbmr.org). Moreover, while relatively little is known about osteoporotic risk factors in women in the Indian subcontinent, osteoporotic fractures usually occur 10–20 years earlier in Indian women and men than their western Caucasian counterparts.[7,10] Data also

suggests that the incidence of hip fracture in India is one woman to one man, while in places like Australia it is three women to one man. We, however, are still to wake up to need for optimal bone health of the Indian male population. According to recent publications,[17-19] structured programs run by the Indian Society of Bone and Mineral Research have led to enhanced awareness and set standards of care for health professionals with significant impact on osteoporosis care in India.

With public awareness and education as the focus, the International Osteoporosis Foundation (IOF)[17-19] is helping to raise awareness and improve knowledge about osteoporosis among the public, health professionals and policy makers through programs and projects. Media outreach is carried out through active news service with press releases issued regularly to international media, advertising campaigns and most importantly through awareness programmes on Annual World Osteoporosis Day (20th October). IOF supports global campaign by issuing educational publications viz., 'Invest in Your Bones' series, creating poster artwork and carrying out special events. Each May, National Osteoporosis Foundations (NOF) in US (http://www.nof.org/), Europe (http://www.esceo.org/) and Japan (http://www.jpof.or.jp/) also celebrate Osteoporosis Awareness and Prevention Month with themes, messages and activities built towards increasing awareness of and action related to osteoporosis and bone health at grassroots level.

The US NOF has also launched a new 'Know My Bones Educational Program' (www.knowmybones.com) to encourage women living with postmenopausal osteoporosis to prioritize their bone health and seek information that will empower them to fight the disease in addition to receiving information on calcium rich recipes and helpful lifestyle tips to optimally manage osteoporosis. The IOF also offers a new interactive IOF one-minute osteoporosis risk test available online in different languages.[18] It consists of 19 easy questions to help a person understand the status of her/ his bone health.

The World Health Organisation has also launched a Fracture Risk Assessment Tool (or FRAX)[20] to evaluate fracture risk of patients. It is a computer-driven tool available on site and is based on individual patient models that integrate risks associated with clinical risk factors and BMD at femoral neck. FRAX algorithms give 10-year probability of fracture. The output is a 10-year probability of hip fracture and 10-year probability of major osteoporotic fracture (clinical spine, forearm, hip or shoulder fracture). Pertinently, while FRAX models have been developed from studying population-based cohorts and calculation tools are available for countries such as Argentine, Austria, Belgium, China, Finland, France, Germany, Hong Kong, Italy Japan, Lebanon, New Zealand, Spain, Sweden, Switzerland, Turkey, UK and US (Caucasian, Black, Hispanic & Asian), but in the absence of such calculation tool for India, it is not possible even for the few Indians having their BMD at the femoral neck values to access this important information. It may be pertinent to mention that in India the first Dual Energy X-ray Absorptiometry (DEXA) machine was installed in 1997 and while number of scanners is steadily increasing in the country, their availability remains confined only to the urban areas and that too with prohibitive costs for the common man.[17] However, people in India still remain unaware of the need to know the status of their bones. Response that one of the authors (MMS and co-workers) encountered during a study aimed to generate normative bone mineral density data at multiple skeletal sites in Indian subjects[7] included the common myth (http://www.iofbone health.org/patients-public/about-osteoporosis/osteoporosis-myths.html) of unnecessary exposure to lot of radiation. Surprisingly, many senior citizens, both men and women, also refused to undertake free DXA scans with to-and-fro transport (under a project funded by the Department of Science & Technology, Government of India) as they thought that Indians cannot have osteoporosis because of so much sunlight throughout the year and dietary intake of phytoestrogens.

Incidentally, a recent survey conducted by the IOF in 13 countries across Europe and Australia, showed that while patients fear the impact of osteoporosis on quality of life such as breaking a bone and reduced activity, they lack appropriate information and tools to address these concerns and improve osteoporosis management.[19] According to this survey, challenges with osteoporosis management could be addressed through improved communication networks for patients and physicians. In response to this, the IOF has on 13 September 2009 launched a novel community based networking program 'OsteoLink' to address unmet needs in osteoporosis management through digital and in-person patient and physician communication networks across Europe and Australia.

To the best of our knowledge, this is the first report on awareness about osteoporosis among Indian girl students. Undergraduate and postgraduate students were considered appropriate because, girls staying away from home in hostel despite facing several behavioral and nutritional constraints, generally feel more comfortable due to greater freedom in the choice of (though not necessarily healthy) food and recreational activities thus compromising their attention towards health. Moreover, regardless of knowledge of harmful effects, they are likely to get exposed to many modifiable risk factors such as smoking, alcohol intake, anorexia, bulimia etc. Osteoporosis is a disease that may be prevented throughout life, but it is particularly important to begin primary prevention during childhood and adolescence. Our choice of girl students for this study was also based not only on the fact that it is during this age that they have ability to understand the concepts of physiology, bone, sex

hormones etc. and need to make concerted effort to attain higher peak bone mass and improve quality of bones by modifying their physical activities and dietary habits, but also because they are mothers of tomorrow. Greater awareness among them would not only help achieve high peak bone of their children, but also effectively manage general as well as bone health of all members of the family while ageing. Pertinently, risk of developing osteoporosis is determined by the amount of bone mass accumulated during active growth phase early in life[21] and ageing and post-menopausal bone loss cause progressive loss of bone-forming osteoblasts.[22] It is also well established that risk of osteoporotic fractures in an individual later in life can be minimized by attaining higher peak bone mass.

The persisting gap in health knowledge and practices among young girls and masses in India and other developing and underdeveloped countries can be reduced through education and introduction of healthy behaviors. This will rightly draw attention to the importance of prevention and early detection of osteoporosis. While osteoporosis has frequently been termed as a 'silent disease', due to the fact that it is asymptomatic until fracture occurs, the term 'silent', in the current context, appears to be most appropriate way to describe scant attention this disease has received until recently in the developed world and is continuing to be so in underdeveloped and developing world, despite its being associated with serious physical and psycho-social consequences. According to Prof. Rene Rizzoli, IOF Vice Chairman of Committee of Scientific Advisors, people with osteoporosis fear emotional and physical impact that osteoporosis has on their lives, but because they are often not as well informed as they think, their osteoporosis is not well managed. This leads to increased risk of fracture and reduced quality of life.[19]

CONCLUSION

Present study demonstrates low-level of awareness about osteoporosis among young India girls students with undergraduate students exhibiting 1.26 fold lower awareness level and 1.31 times greater risk of osteoporosis than postgraduates.

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REFERENCES

1. Henry BJ. Clinical Diagnosis and Management by Laboratory Methods. 12th ed. WB Saunders Company, Philadelphia, USA. 2001, 1-1512.
2. Liggett NW, Reid DM. The incidence, epidemiology and aetiology of osteoporosis. Hosp Pharmac 2000; 7: 62-8.
3. Ferguson N. Osteoporosis in Focus. Pharmaceutical Press, London, UK. 2004, 1-229.
4. Singh BP, Makker A, Tripathi A, Singh MM, Gupta V. Association of testosterone and bone mineral density with tooth loss in men with chronic periodontitis. J Oral Sci 2011; 53: 333-9.
5. Narayana Murthy PS, Tripathi A, Singh R, Mathur R, Singh MM. Current trends in the clinical utility of bone mineral density to assess fracture risk in postmenopausal osteoporosis. In. Advances in Medicine and Biology. Berhardt LV, (ed), vol. 8, Nova Science Publishers, Inc., New York. 2010, 165-90.
6. Kanis JA. Diagnosis of osteoporosis and assessment of fracture risk. Lancet 2002; 359: 1929-36.
7. Makker A, Mishra G, Singh BP, Tripathi A, Singh MM. Normative bone mineral density data at multiple skeletal sites in Indian subjects. Arch Osteopor 2008; 3: 25-37.
8. Gupta A. Osteoporosis in India - the nutritional hypothesis. Nat Med J India 1996; 9: 268-74.
9. Handa R. Action plan osteoporosis: Consensus statement of the expert group meeting, Osteoporosis Society of India, New Delhi, 2003; 1-40. (Available from: http://www.osteofound.org/press_centre/fact_sheet.html).
10. Alekel DL, Mortillaro E, Hussain EA, West B, Ahmed N, Peterson CT, Werner RK, Arjmandi BH, Kukreja SC. Lifestyle and biologic contributors to proximal femur bone mineral density and hip axis length in two distinct ethnic groups of premenopausal women. Osteopor Int 1999; 9: 327-38.
11. Sridhar CB, Ahuja MMS, Bhargava S. Is osteoporosis a nutritional disease? J Assoc Physic India 1970; 18: 671-6.
12. Khanna P, Bhargava S. Roentgen assessment of bone density in North Indian population. Indian J Med Res 1971; 59: 1599-609.
13. Palacios S, Sánchez-Borrego R, Neyro JL, Quereda F, Vázquez F, Pérez M, et al. Knowledge and compliance from patients with postmenopausal osteoporosis treatment. Menopause Int 2009; 15: 113-9.
14. Pande K, Pande S, Tripathi S, Kanoi R, Thakur A, Patle S. Poor knowledge about osteoporosis in learned Indian women. J Assoc Phys India 2005; 53: 433-6.
15. Werner P. Knowledge about osteoporosis: Assessment, correlates and outcomes. Osteopor Int 2005; 16: 115-27.
16. Vered I, Werener P, Shemy G, Stone O. Nurses' knowledge and perceptions about osteoporosis: A questionnaire survey. Int J Nursing Stud 2008; 45: 847-54.
17. International Osteoporosis Foundation. The Asian Audit: Epidemiology, costs and burden of osteoporosis in Asia. 2009. (Available from: http://www.iofbonehealth.org/publications.html).
18. International Osteoporosis Foundation. The NEW Interactive IOF One-Minute Osteoporosis Risk Test. 2009; (Available from: http://www.iofbonehealth.org/patients-public/risk-test.html).
19. International Osteoporosis Foundation. Patients fear osteoporosis quality of life impact, yet lack tools to manage concerns and improve osteoporosis outcomes, new survey says. 2009; (Available from: http://www.iofbonehealth.org/news/news-detail.html?newsID=287).
20. World Health Organisation. FRAX: Identifying people at high risk of fracture, 2009; 1-16. (Available from: http://www.shef.ac.uk/FRAX).
21. Root AW, Root MJ. Clinical pharmacology of human growth hormone and its secretagogues. Curr Drug Targets - Immune, Endocr Metab Disord 2002; 2: 27-52.
22. Manolagas SC. Birth and death of bone cells: Basic regulatory mechanisms and implications for the pathogenesis and treatment of osteoporosis. Endocr Rev 2000; 21: 115-37.