

Bone Mineral Density (BMD) Status and its Determinants in Rural Women of Reproductive Age

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Abstract

Background: To determine the prevalence of low bone mineral density (BMD) and its main determinants in rural women of reproductive age.

Methods: In this cross sectional study women attending antenatal clinic/ gynae OPD belonging to reproductive age (15-45 years) were included. Those menopausal, taking steroids, having hyperthyroidism, Cushing's disease were excluded. Age of all patients, weight/height (BMI), socio-economic status, education, working/non working, pregnancy, parity, intake of milk and milk products, exposure to sun light, smoking, were noted. Calcaneal quantitative sonometry was used to measure Z-score. Criteria for pre-menopausal women for low BMD/osteoporosis was used.

Results: Out of 425 women, 58.9 % had low BMD/osteoporosis; out of them 50.1 % had low BMD or osteopenia, and 8% had osteoporosis. Mean age was 26.68 ± 6.79 years, minimum age 15 years, maximum age 45 years; 89.0 % were having income < 15,000/- monthly. Out of all determinants mentioned above, poor socio-economic status and low intake of milk and milk products were statistically significantly associated with low BMD/osteoporosis.

Conclusion: More than half of the women had either low BMD or osteoporosis. Low intake of milk and milk products and poor socio-economic status were mainly significant determinants.

Key Words: Bone mineral density, BMD, Rural women, Reproductive age

Introduction

Low bone mass has been one of the commonest silent problems globally. Its less severe form is osteopenia, while osteoporosis is the extreme one. It is associated with serious risks like fractures. About 75 million people in Japan, USA and Europe have been affected by osteoporosis.^{1,2} In developing countries its prevalence is even greater due to lack of public awareness.³

A study from Iran revealed low peak bone mass in 20-39 year age group. Another study from Saudi Arabia

indicated low BMD in women <35 years of age, due to high parity and prolonged lactation.⁴ South East Asian women are more prone to these problems. Poverty, less active life style, high parity, prolonged lactation, imbalanced and inadequate diet are the precipitating factors.⁵

Pakistan has a population of 190 million, 51 % women, total no. of women in 15-49 years age group is 46,198,129. Adolescent fertility rate is 31/1000.^{6,7} Per capita income in Pakistan is low and a large segment of society living under the poverty line. Literacy rate, economic independence, uptake of family planning are quite low in Pakistan.⁴ High parity, repeated pregnancies and lactation further increase the risk of osteopenia and osteoporosis at a younger age leading to serious risks for health.⁵ This is specially important in the context of low daily intake of calcium that is according to one study 346mg./day. High prevalence of osteopenia in young women, i.e., 64% in those <30 years of age, 55% in those 31-45 years of age, has been reported. A study from KPK Pakistan shows osteopenia in 47.7% and osteoporosis in 24.7% women.^{8,9} Peak bone strength is acquired by the age of 30 years followed by slow decline in bone strength which becomes more marked after menopause.

During pregnancy and lactation, mobilization of calcium occurs from maternal bones to the developing fetal bones thus increasing the risk of osteopenia, and osteoporosis at a younger age and enhancing the possibility of back and pelvic pain adding to poor quality of life.⁹⁻¹¹

Dual energy X-ray absorptiometry is the gold standard for diagnosis of osteoporosis. However in Pakistan only 0.1/million DEXA machines are available, furthermore forearm single x-ray absorptiometry is one of the most precise bone densitometry methods, being cheap, readily standardized, hence good for BMD screening.¹² Quantitative Ultrasound-based BMD assessment depends on speed of sound and broad band ultrasound attenuation at heel and other peripheral sites, another cheap, reliable method for BMD assessment.¹³

Subjects and Methods

This cross sectional study was performed in Gynecology & Obstetrics Department of Avicenna Medical College, Lahore. Duration of study was 6 months. By convenient sampling 425 women of reproductive age were included. Women more than 45 years age, menopausal women, on steroid therapy, having hyperthyroidism and Cushing's disease were excluded. Osteopenia was defined as decreased bone density less than normal but short of osteoporosis. Osteoporosis was defined as bone mineral density Z score (< - 2.0) less than two standard deviation for normal. BMD of each patient was measured using Sonost 3000, Calcaneal Ultrasonometry based assessment of bone mineral density. This is a reliable screening method for detection of changes in BMD especially in poor settings where DEXA machines are scarcely available.¹³ Both T and Z scores were noted. Since women were premenopausal WHO criteria was not used which is for postmenopausal women and utilizes T scores. An ICSD criterion is used for premenopausal women.^{14,15}

Results

Mean age of patients was 26.68 ± 6.79 years (Range: 15-45 years). Maximum number of females (87.5%) were non-working. Eight eight (20.7%) females were pregnant. According to parity 37(8.7%) had no issue. Seventy five (17.6%) were not using any milk product. Ninety three (45.4%) reported not having intake of calcium. A total of 19.3% females had no exposure of sunlight. Majority (87.3%) females were non-smokers (Table 1). According to BMD osteopenia was found in 50.1%. (Table 2). Significant association was found between osteopenia and osteoporosis in females belonging to 10,000 -15,000/- PKR/month income groups (p-value 0.008) and in those who were taking one glass of milk or one yogurt and two glass of milk or one glass milk +yogurt (p-value 0.003).

Discussion

In this study, population was predominantly rural, 58.3 % had low bone mineral density (BMD) that is more than half of women of reproductive age, lower than that found in a study from KPK, and in another study 64% of those under 30 years of age had low BMD. In an Egyptian study low BMD was found in 31.8 % women.^{5,16} The difference in BMD between urban and rural population may vary from place to place however, in rural areas more of physical activity, less pollution contributes to better BMD compared to urban areas.¹⁷ BMD is the cumulative result of bone deposited from prenatal period till the

age of maturity (around 30 years of age) and bone lost under influence of both internal and external factors.¹⁸

Table-1: Frequency distribution of study variables

| Variables | Status | No | Percentage |
|-------------------------------|---------------------|-----|------------|
| Pregnancy | Yes | 88 | 20.7 |
| | No | 337 | 79.3 |
| Socioeconomic status | <5000 | 8 | 1.9 |
| | 5000-10000 | 167 | 39.3 |
| | 10000-15000 | 203 | 47.8 |
| Parity | > 15000 | 47 | 11.1 |
| | No issue | 37 | 8.7 |
| | PG | 113 | 26.6 |
| | Multigravida | 155 | 36.5 |
| | Grand parity | 117 | 27.5 |
| Smoking | Unmarried | 3 | 0.7 |
| | No smoking | 371 | 87.3 |
| BMI | Passive smoking | 54 | 12.7 |
| | <19 | 10 | 2.4 |
| | Normal BMI | 212 | 49.9 |
| Sunlight exposure | >25 | 203 | 47.8 |
| | No exposure | 82 | 19.3% |
| | Occasional exposure | 336 | 71.6 |
| Intake of milk | Regular exposure | 7 | 9.1 |
| | No use of milk | 75 | 17.6 |
| | One glass of milk | 140 | 32.9 |
| | 2 glass of milk | 191 | 44.9 |
| Intake of calcium supplements | > 2 glass of milk | 79 | 4.5 |
| | No calcium intake | 193 | 45.4 |
| | Occasional intake | 142 | 33.4 |
| | Regular use | 90 | 21.2 |

Table 2: Bone Marrow Density

| Status | Bone Density |
|----------------------------|--------------|
| Osteopenia | 213 (50.12) |
| Normal bone marrow density | 174(40.94) |
| Osteoporosis | 38(40.94) |

Daily intake of calcium in Pakistani diet is 400-600 mg./day that is half of that required for normal health and low intake of calcium is one of the important factors contributing to poor bone health.^{1,19} Factors such as dietary calcium, vitamin D, exposure to sunlight, intake of calcium supplements influence BMD directly. One glass of milk provides 362 mg calcium. Food rich in calcium are: milk, yogurt, cheese, dark green vegetables, almond, salmon.²⁰

Exposure of bare skin of the body to sunlight leads to production of 25-dihydroxy cholecalciferol. Vitamin D is essential for calcium absorption from intestine. Dietary source being inadequate, since sunlight exposure is dependent on time in day, colour of skin and bare skin area exposed, supplementary source of vitamin D along with calcium becomes essential. Sunlight exposure was not significantly associated with low BMD in this study. Intake of calcium supplements on regular basis was practiced by 21.2%, no use of calcium supplements by 45% of participants. Information about the type of salt, and dose was lacking hence difficult to correlate its impact on BMD. Factors pertaining to affordability of good quality diet and attitude such as socio-economic status, working/non working status and education were also studied. Poor socio-economic status was significantly associated with low BMD (p-value: 0.008). Poor socio-economic status was found significantly associated with low BMD in other studies as well.¹⁶

During pregnancy 200 mg. calcium /day is needed for growth of fetal bones, and 200-400 mg. is secreted in breast milk daily.²¹ The impact of pregnancy, parity on BMD was not significant statistically although in other studies this has been found significant in some, and inconsistent in other studies.^{15,22,23}

Body Mass Index (BMI) was not significantly associated with low BMD, in this study as well as in another study.²⁴ Since there is no cut off level of BMD and fractures occur in those with low bone mass, hence the significance to identify those with low bone mass (osteopenia) and osteoporosis to prevent/treat the condition effectively by advising active life style, adequate intake of milk and milk products, supplementary calcium especially in pregnancy and lactation to improve quality of life of our young women and reduce the risk of serious morbidity and even mortality in later life.

Conclusion

1. More than half of the women had either low BMD or osteoporosis.
2. Low intake of milk and milk products and poor socio-economic status were mainly significant determinants.

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