

# Prevalence and Related Risk Factors of Osteoporosis and Osteopenia among Peri and Post Menopausal Women

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**Abstract:** ***Introduction:** Menopause is an important phase in the life of a woman as she spends 1/3<sup>rd</sup> of her life in this phase. Estrogen deprivation during this phase is characterised by vasomotor symptoms, genitourinary tract symptoms, cancers, cardiovascular disease, cognitive disturbances and most importantly osteoporosis and related fractures. Among women aged above 45years, osteoporosis accounts for more days spent in hospital than any other disease. The aim of the study was to assess the prevalence of osteoporosis and osteopenia and its related risk factors in women of age 45 to 65 years. **Methodology:** A cross sectional observational study involving 250 peri and post menopausal women of the age group 45-65yrs who attended the gynaec OPD who fulfilled the inclusion criteria were selected till the required number of sample size using consecutive number method. A detailed proforma containing BMI, diet, T score, serum calcium, serum magnesium and serum alkaline phosphatase, duration of exercise, medical, obstetrical, menstrual, surgical and drug history was designed for the study. **Results:** Our study showed that out of the 250 patients studied the prevalence of osteoporosis in the age group 45-65years is 12.8%. Prevalence of osteopenia is 50%. Normal population is 37.2%. Mean age of the population is 51.61 ± 6.88SD. 58.4% of the people belonged to 45-50years, 11.65% belonged to 51-55years. 14% belonged to 56-60yrs and 16% belonged to 61-65years. Mean T score of the population is -1.431±0.756SD which refers to osteopenia. There is a statistically significant association between T score and age, BMI, socio economic status, educational qualification, parity, years since menopause, duration of hysterectomy, family history of osteoporosis, serum calcium level, duration of exercise, mean calorie intake, mean protein intake and comorbidities like diabetes mellitus, hypertension, hypothyroidism with a p value of <0.05. Age, BMI, socioeconomic status, years since menopause and duration of hysterectomy showed statistically significant correlation with T score with a p value <0.05. BMI had a negative correlation with T score while others had a positive correlation. **Conclusion:** The Osteoporosis and Osteopenia prevalence were found to be high and alarming in postmenopausal women due to dietary and lifestyle risk. The study indicated that majority of the postmenopausal women predisposed to low BMD and osteoporosis are under diagnosed or under treated in this population.*

**Keywords:** Menopause, Osteoporosis, T Score, BMD

## 1. Introduction

Menopause is an important phase in the life of a woman. Women spend about quite one-third of their lives during this phase. World Health Organization (WHO) defines natural menopause as at least 12 consecutive months of amenorrhea not due to surgery or any other cause. The mean age at natural menopause is 51 years in developed countries, while it is 48 years in poor and non-industrialized nations [1],[2]. Menopause is a result of primary ovarian failure secondary to apoptosis [3]. Peri menopause generally refers to the late reproductive years, usually late 40s and early 50s. The average age at its onset is 47 and menopausal transition typically spans 4- 7yrs [4]. Principal health concerns of menopausal women include vasomotor symptoms, urogenital atrophy, cardiovascular disease, cancer, cognitive decline, osteoporosis related fractures and sexual problems [4]. Among the perimenopausal women osteoporosis accounts for more days spent in hospital than many other diseases, including diabetes, myocardial infarction and breast cancer. According to International Osteoporosis

Foundation (IOF) osteoporosis causes more than 8.9 million fractures annually, that results in an osteoporotic fracture to occur every 3 seconds [5].

Osteoporosis is considered as a disease characterized by microarchitectural deterioration of the bone tissue, with bone mass reduction to insufficient levels for providing support, leading to high risk of developing fracture. As per WHO( World Health Organization) criteria, osteoporosis is a disorder with Bone Mineral Density (BMD) 2.5 or more standard deviations less than that of mean BMD in healthy young adults, {T score -2.5 or less}. T score compares the patient's bone mass with peak bone mass of a younger person. {-1.0 or above is normal; from - 1.0 to -2.5 suggests mild bone loss or osteopenia; -2.5 or below indicates osteoporosis}. The Z-score compares the patient's bone mass with that of other people with similar build and age [6]. Nevertheless, this condition produces no or little clinical manifestations, due to which the patients often go undiagnosed until a fracture occurs. Due to this reason, early diagnosis of this condition is extremely necessary for

reducing the hazard of fractures. Post-menopausal osteoporosis is a chronic disease that requires a well-planned treatment for longer duration.

Measuring bone mineral density (BMD) is the most important tool in the diagnosis of osteoporosis. The gold standard for measuring BMD is the dual-energy X-ray absorptiometry (DEXA) densitometer, a specialized X-ray device that precisely quantifies BMD at the spine, femur, and other skeletal sites. Evaluation of BMD by DEXA is recommended by WHO for all women aged 65 and older, regardless of risk factors and for younger post-menopausal women with one or more risk factors, other than being white and post menopaual [7]. But due to the high cost of DEXA, it is not feasible in the Indian setting.

Another most commonly utilized modality inspecting the bone density is calcaneal QUS (quantitative ultrasonography). Ultrasound bone sonography is a safe, non-ionizing modality which provides precise quantitative assessment of skeletal status in just 10 seconds at an affordable rate.

## 2. Methodology

A cross sectional observational study involving 250 peri and post menopausal women of the age group 45-65yrs who attended the gynaec OPD at JMMC & RI, Thrissur, during the study period (January 2019 to June 2020) who fulfilled the inclusion criteria were selected till the required number of sample size using consecutive number method. A detailed proforma containing medical, obstetrical, menstrual, and drug history was designed for the study. Past history of diseases like hyperparathyroidism, rheumatoid arthritis, chronic liver disease, renal disease, chronic malabsorption syndrome, current or past treatment with glucocorticoids and use of OCPs and HRT, past fracture history, family history of fracture and osteoporosis, socio economic status, occupation, education level and weight bearing exercises for at least 30mts were noted. BMI was calculated using weight (kg)/height(m<sup>2</sup>). Food intake was estimated using 24 hour dietary recall method. Calcaneal BMD was measured using clinical bone sonometer after informed consent. Serum calcium, serum magnesium and serum alkaline phosphatases of all participants were measured after informed consent.

Inclusion criteria -Women of age between 45 and 65yrs who have consented for the study

Exclusion criteria- pregnant women, women with documented osteopenia or osteoporosis, non ambulatory women, individuals with chronic liver disease, chronic renal disease or osteogenesis imperfecta, individuals with presence of malignancy, individuals with h/o hyperparathyroidism, rheumatoid arthritis, chronic malabsorption syndrome, current or past treatment with glucocorticoids /antiepileptics/aromatase inhibitors/anti-depressants, individuals with h/o use of OCPs for at least 5yrs, post-menopausal women who have undergone HRT (hormone replacement therapy), individuals who have underwent hysterectomy with bilateral oophorectomy.

## 3. Results

Table 1: Age distribution of patients

Age group	Total	Percentage (%)
45-50yrs	146	58.4
51-55yrs	29	11.6
56-60yrs	35	14
61-65yrs	40	16
Total	250	100

Mean age of the population is 51.61 ± 6.88SD. 58.4% of the people belonged to 45-50years, 11.65% belonged to 51-55years. 14% belonged to 56-60yrs and 16% belonged to 61-65years

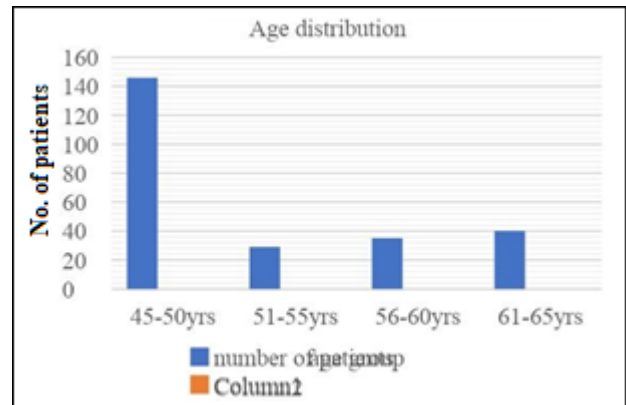


Figure 1: Age distribution

Table 2: Age & T score

Age	Normal	Osteopenia	Osteoporosis
45-50years	58.2% (85)	41.1% (60)	0.7% (1)
51-55years	20.7% (6)	79.3% (23)	0 (0)
56-60years	5.7% (2)	77.1% (27)	17.1% (6)
61-65years	0 (0)	37.5% (15)	62.5% (25)

Mean T score of the population is -1.43±0.76SD. Among 45-50yrs 58.2% had normal T score (i.e., >-1) and only 0.7% had osteoporosis. Among 51-55yrs 79.3% had osteopenia and 20.7% had normal T score. Among 56-60yrs 77.1% had osteopenia and 17.1% had osteoporosis. Among 61-65yrs 62.5% had osteoporosis and 37.5% had osteopenia.

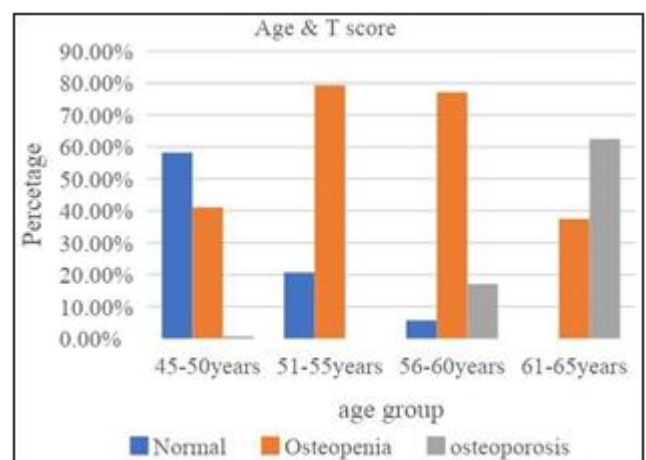


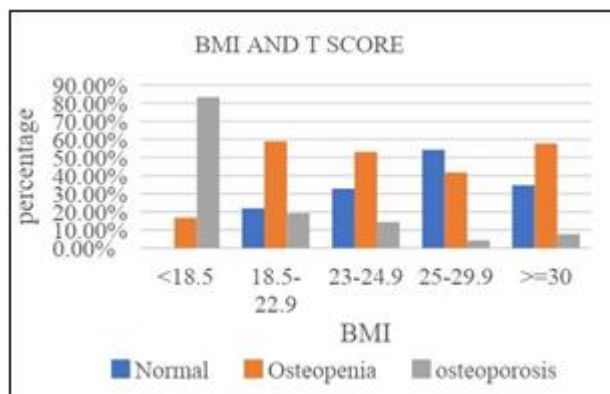
Figure 2: Age & T score

Prevalence of osteoporosis in the age group 45-65years is 12.8%. Prevalence of osteopenia in the age group 45-

65years is 50%. Normal population is 37.2%. There is a statistically significant association between age and T score with a p value of 0.00

**Table 3: BMI and T score**

BMI(Kg/m <sup>2</sup> )	Normal	Osteopenia	osteoporosis	Total no patients
<18.5 (underweight)	0 (0)	16.7% (1)	83.3% (5)	6
18.5-22.9 (normal)	21.9% (16)	58.9% (43)	19.2% (14)	73
23-24.9 (overweight)	32.7% (16)	53.1% (26)	14.3% (7)	49
25-29.9 (obese class I)	54.2% (52)	41.7% (40)	4.2% (4)	96
≥30 (obese class II)	34.6% (9)	57.7% (15)	7.7% (2)	26



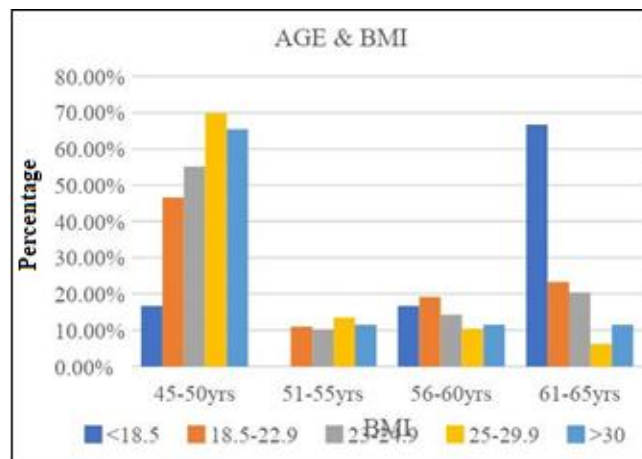
**Figure 3: BMI & T score**

Mean BMI of the population is 25.02 ± 3.97. 2.4% of the patients were underweight, 29.2% had normal BMI, 19.6% were overweight, 38.4% of the patients belonged to obese class I and 10.4% belonged to obese class II. Among those patients with BMI <18.5, 83.3% had osteoporosis and none had normal BMI. Among those patients with normal BMI 58.9% had osteopenia and 19.2% had osteoporosis. Among patients who are overweight 53.1% had osteopenia and 14.3% had osteoporosis. Of obese class I and class II 4.2% and 7.7% had osteoporosis respectively; 54.2% and 34.6% had normal T score respectively. There is a statistically significant association between BMI and T score with a P value of 0.00

**Table 4: Age and BMI**

BMI	age			
	45-50yrs	51-55yrs	56-60yrs	61-65yrs
<18.5	16.7% (1)	0 (0)	16.7% (1)	66.7% (4)
18.5-22.9	46.6% (34)	11% (8)	19.2% (14)	23.3% (17)
23-24.9	55.1% (27)	10.2% (5)	14.3% (7)	20.4% (10)
25-29.9	69.8% (67)	13.5% (13)	10.4% (10)	6.2% (6)
>30	65.4% (17)	11.5% (3)	11.5% (3)	11.5% (3)

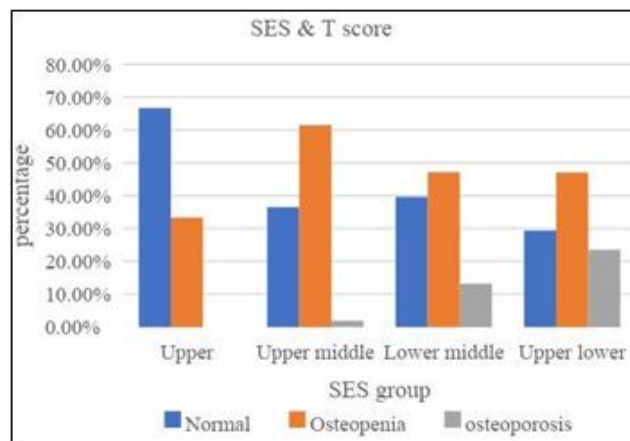
Of the age group 61-65years 66.7% had a BMI of <18.5 i.e. underweight and 69.8% of age group 45-50yrs had a BMI of 25-29.9 that is obese class I. There is a statistically significant association between age and BMI with a P value of 0.005



**Figure 4: Age & BMI**

**Table 5: Socioeconomic status & T score**

SES	Normal	Osteopenia	osteoporosis	Total no
Upper	66.7% (2)	33.3% (1)	0 (0)	3
Upper middle	36.5% (19)	61.5% (32)	2% (1)	52
Lower middle	39.6% (57)	47.2% (68)	13.2% (19)	144
Upper lower	29.4% (15)	47.1% (24)	23.5% (12)	51



**Figure 5: SES & T score**

57.6% of the patients belonged to lower middle socioeconomic class. Among the upper socioeconomic class none had osteoporosis. Among lower middle class 47.2% had osteopenia and 13.2% had osteoporosis and among upper lower class 47.1% had osteopenia and 23.5% had osteoporosis. There is a statistically significant association between SES and T score with a P value of 0.037

**Table 6: Educational status & T score**

Education	Normal	Osteopenia	osteoporosis	Total no
Illiterate	0 (0)	80% (4)	20% (1)	5
Primary school	0 (0)	54.5% (18)	45.5% (15)	33
Middle school	37.8% (14)	48.6% (18)	13.5% (5)	37
High school	43.5% (50)	47% (54)	9.6% (11)	115
Intermediate	52% (13)	48% (12)	0 (0)	25
Graduate or PG	46.9% (15)	53.1% (17)	0 (0)	32
Professional	33.3% (1)	66.7% (2)	0 (0)	3

Among those patients who had an education of intermediate school degree & above none had osteoporosis. 70% had an educational qualification of high school degree and above. There is a statistically significant association between

educational status and T score with a P value of 0.00

**Table 7: Mean calorie intake & T score**

Mean calorie intake	Normal	Osteopenia	osteoporosis	Total no
<1900 Kcal/d	2.1% (1)	57.4% (27)	40.4% (19)	47
≥1900 Kcal/d	45.3% (92)	48.3% (98)	6.4% (13)	203

Mean calorie intake of the population is 2034.9 ± 198.96. 18.8% had a mean calorie intake <1900 Kcal/d and 81.2% had a mean calorie intake of ≥1900Kcal/d. Among those patients with a mean calorie intake of <1900Kcal/d 57.4% had osteopenia and 40.4 % had osteoporosis. Among those patients with a mean calorie intake of ≥1900Kcal/d 48.3% had osteopenia and 6.4% had osteoporosis. There is a statistically significant association between mean calorie intake and T score with a P value of 0.00

**Table 8: Mean protein intake & T score**

Mean protein intake(grams/day)	Normal	Osteopenia	osteoporosis	Total
<55	2.1% (1)	57.4% (27)	40.4% (19)	47
≥55	45.3% (92)	48.3% (98)	6.4% (13)	203

Mean protein intake of the population is 52.78 ± 4.99. 18.8% had a mean protein intake <55g/d and 81.2% had a mean protein intake of ≥55g/d. Among those patients with a mean protein intake of <55g/d, 57.4% had osteopenia and 40.4 % had osteoporosis. Among those patients with a mean protein intake of ≥55g/d, 48.3% had osteopenia and 6.4% had osteoporosis. There is a statistically significant association between mean protein intake and T score with a P value of 0.00

**Table 9: History of comorbidities & T score**

HTN/Thyroid/Diabetes	Normal	Osteopenia	Osteoporosis	Total
None	47.3% (71)	42.7% (64)	10% (15)	150
Hypertension	16% (4)	52% (13)	32% (8)	25
Diabetes	20.8% (5)	58.3% (14)	20.8% (5)	24
Thyroid	40.7% (11)	55.6% (15)	3.7% (1)	27
HTN+ thyroid	6.2% (1)	87.5% (14)	6.2% (1)	16
DM+ thyroid	14.3% (1)	57.1% (4)	28.6% (2)	7
HTN+DM	0	100% (1)	0	1

60% of the population did not have any comorbidities. 10% had hypertension of which 32% had osteoporosis and 52% had osteopenia. 9.6% had diabetes of which 20.8% had osteoporosis and 58.3% had osteopenia. 10.8% had thyroid disease(that is hypothyroidism) of which 3.7% had osteoporosis and 55.6% had osteopenia.6.4% had both hypertension and thyroid disease of which 6.2% had osteoporosis and 87.5% had osteopenia. There is a statistically significant association between history of any of the comorbidities like hypertension, diabetes and thyroid disease and T score with a P value of 0.00

**Table 10: Age at menarche & T score**

Age at menarche	Normal	Osteopenia	osteoporosis	Total
11-14yrs	37.6% (71)	48.7% (92)	13.8% (26)	189
>14yrs	36.1% (22)	54.1% (33)	9.8% (6)	61

Mean age at menarche of the population is 13.52 ± 1.44.

75.6% attained menarche between 11-14years of age and 24.4% attained menarche beyond 14 years of age. There is no statistically significant association between age at menarche and T score with a P value of 0.653.

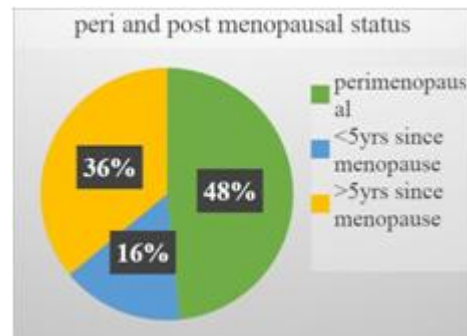
**Table 11: Parity & T score**

Parity	Normal	Osteopenia	osteoporosis	Total
Nullipara	37.5% (9)	50% (12)	12.5% (3)	24
Multiparous (≤2 children)	46% (64)	45.3% (63)	8.6% (12)	139
Multiparous (≥2 children)	23% (20)	57.5% (50)	19.5% (17)	87

Among the multiparous women (≥2 children) 57.5% had osteopenia and 19.5% had osteoporosis. There is a statistically significant association between parity and T score with a P value of 0.007

**Table 12: Years since menopause & T score**

Years since menopause	Normal	Osteopenia	osteoporosis	Total
Not attained	62% (75)	37.2% (45)	0.8% (1)	121
<5yrs	33.3% (13)	66.7% (26)	0 (0)	39
>5yrs	5.6% (5)	60% (54)	34.4% (31)	90



Mean age at menopause of the population is 44.33 ± 4.85. Among those women who have not attained menopause 37.2% had osteopenia and 0.8% had osteoporosis. Among those group who were menopausal for >5yrs 34.4% had osteoporosis and 60% had osteopenia. There is a statistically significant association between years since menopause and T score with a P value of 0.00

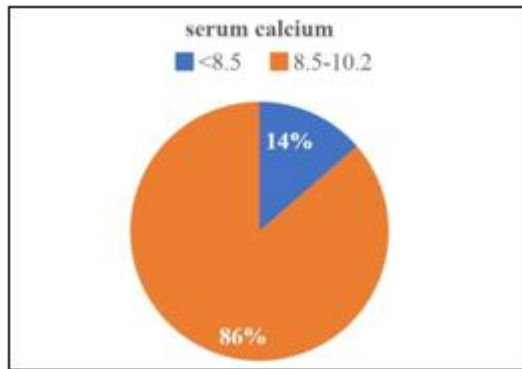
**Table 13: Duration of hysterectomy and T score**

Duration of hysterectomy	Normal	Osteopenia	osteoporosis	total
Hysterectomy not done	40.4% (90)	48% (107)	11.7% (26)	223
<5yrs since hysterectomy	40% (2)	40% (2)	20% (1)	5
>5yrs since hysterectomy	4.5% (1)	72.7% (16)	22.7% (5)	22

Among those patients with a history of hysterectomy for >5yrs 72.7% had osteopenia and 22.7% had osteoporosis. There is a statistically significant association between duration of hysterectomy and T score with a P value of 0.021

**Table 14:** Serum calcium & T score

S. calcium(mg/dl)	Normal	Osteopenia	osteoporosis	total
<8.5	11.8% (4)	38.2% (13)	50% (17)	34
8.5-10.2	41.2% (89)	51.9% (112)	6.9% (15)	216



Mean serum calcium level of the population is  $8.67 \pm 0.44$ . Out of 250 patients 216 had normal serum calcium levels and 34 patients had low serum calcium. Of those group with low calcium levels 50% had osteoporosis and 38.2% had osteopenia.

There is a statistically significant association between serum calcium and T score with a P value of 0.00

**Table 15:** Serum magnesium & T score

Magnesium (meq/L)	Normal	Osteopenia	osteoporosis	Total
<1.5	0 (0)	100% (2)	0 (0)	2
1.5-2.5	37.5% (93)	49.6% (123)	12.9% (32)	248

Mean serum magnesium levels of the population is  $1.96 \pm 0.18$ . 99.2% had normal serum magnesium levels. There is no statistically significant association between serum magnesium and T score with a P value of 0.365

**Table 16:** Serum ALP & T score

ALP(IU/L)	Normal	Osteopenia	osteoporosis	Total
<44	50% (2)	50% (2)	0 (0)	4
44-147	37.3% (91)	49.6% (121)	13.1% (32)	244
>147	0 (0)	100% (2)	0 (0)	2

Mean serum ALP level of the population is  $70.93 \pm 23.07$ . 97.6% of the population had normal ALP levels. There is no statistically significant association between serum ALP levels and T score with a P value of 0.606

**Table 17:** Family h/o osteoporosis & T score

Family h/o osteoporosis	Normal	Osteopenia	osteoporosis	Total
No	40.8% (93)	51.3% (117)	7.9% (18)	228
Yes	0 (0)	36.4% (8)	63.6% (14)	22

91.2% of the population had no family history of osteoporosis while 8.8% had family history of osteoporosis. Among those patients with family history of osteoporosis 63.6% had osteoporosis and 36.4% had osteopenia. There is a statistically significant association between family history of osteoporosis and T score with a P value of 0.00

**Table 18:** Duration of exercise and T score

Duration of exercise	Normal	Osteopenia	osteoporosis	Total no
No exercise	34.1% (79)	52.2% (121)	13.8% (32)	232
Exercise (atleast 30mts)	77.8% (14)	22.2% (4)	0 (0)	18

**Table 19:** Mean and Standard deviation of the variables

variables	mean $\pm$ standard deviation	Reference values
age	$51.61 \pm 6.87$	45-65yrs
T score	$-1.43 \pm 0.75$	-1 and above(N)
BMI	$25.02 \pm 3.97$	18.5-22.9
Mean calorie intake	$2034.9 \pm 198.96$	1900Kcal
Mean protein intake	$52.78 \pm 4.99$	55g
Age at menarche	$13.52 \pm 1.44$	11-14yrs
Age at menopause	$44.33 \pm 4.85$	47-54yrs
Serum calcium	$8.67 \pm 0.44$	8.5-10.2mg/dL
Serum magnesium	$1.96 \pm 0.18$	1.5-2.5 meq/L
Serum ALP	$70.93 \pm 23.07$	44-147 IU/L

**Table 20:** Correlation

Parameters	Pearson's correlational coefficient (r= -1 to +1)	Level of significance (p < 0.05)	Type of correlation
Age	.677	.000	Positive
BMI	-.310	.000	Negative
SES	.154	.015	Positive
Years since menopause	.612	.000	Positive
Duration of hysterectomy	.198	.002	Positive

Age, BMI, socioeconomic status, years since menopause and duration of hysterectomy showed statistically significant correlation with T score with a p value <0.05. BMI had a negative correlation with T score while others had a positive correlation.

#### 4. Discussion

Osteoporosis is a major global public health problem associated with significant morbidity, mortality, and socioeconomic burden. As per WHO criteria, osteoporosis is a disorder with Bone Mineral Density (BMD) 2.5 or more standard deviations less than that of mean BMD in healthy young adults, {T score -2.5 or less}. T score compares the patient's bone mass with peak bone mass of a younger person. {-1.0 or above is normal; from -1.0 to -2.5 suggests mild bone loss or osteopenia; -2.5 or below indicates osteoporosis}. Peri and post menopausal women are at high-risk bone loss due to deficiency of ovarian hormones and are prone for osteoporosis related fractures. It is important to identify those women who are at risk of osteoporosis and correction of the same with calcium and vitamin D supplements as majority of the women attending gynaecology OPD are of peri and post-menopausal age that is 45 to 65yrs.

Our study showed that out of the 250 patients studied the prevalence of osteoporosis in the age group 45-65years is 12.8%. Prevalence of osteopenia in the age group 45-65years is 50%. Normal population is 37.2%. This was

comparable with the study conducted by Lohana CK et al [8] where (40%) amongst all subjects were osteopenic, 114 females (47%) were osteoporotic; whereas, 32 females (13%) were normal based on BMD measurement using DEXA. There is a statistically significant association between age and T score with a p value of 0.00. Mean age of the population is  $51.61 \pm 6.88SD$ . 58.4% of the people belonged to 45-50years, 11.65% belonged to 51-55years. 14% belonged to 56-60yrs and 16% belonged to 61-65years. The age group was similar as in Aggarwal N et al [7] where mean age group was  $52.50 \pm 5.94$ .

Mean T score of the population is  $-1.431 \pm 0.756SD$  which refers to osteopenia. In our study there is a statistically significant association between T score and age, BMI, socio economic status, educational qualification, parity, years since menopause, duration of hysterectomy, family history of osteoporosis, serum calcium level, mean calorie intake, mean protein intake and comorbidities like diabetes mellitus, hypertension, hypothyroidism with a p value of  $<0.05$ . Chin KY et al[9] and Babaroutsi E et al[10] showed BMD depicted by QUS indices is negatively associated with increased chronological age, years since menopause, number of lifetime pregnancies, percentage of body fat, and suboptimal BMI.

Age, BMI, socioeconomic status, years since menopause and duration of hysterectomy showed statistically significant correlation with T score with a p value  $<0.05$ . BMI had a negative correlation with T score which indicate that low BMI is associated with low BMD. Age, socioeconomic status, years since menopause and duration of hysterectomy had a positive correlation with T score which indicate that advanced age, increased years since menopause and duration of hysterectomy and low socioeconomic status had a low BMD.

## 5. Limitation of the study

Due to the large sample size, obtaining the diet history was a cumbersome process in a busy OPD. It would have been beneficial for the patient if followed up after 6months of calcium and vitamin D supplements to check for improvement in the bone mineral density status. Though gold standard method of measuring bone mineral density is using DEXA, could not be done in our setting as it is very expensive.

## 6. Conclusion

Peri and post menopausal women are at high risk of bone loss due decreased steroidogenesis from ovary with age. Our study found out that the prevalence of osteopenia is 50 % and osteoporosis is 12.8% among the age group 45 to 65 years. There is a statistically significant association between T score and age, BMI, socio economic status, educational qualification, parity, years since menopause, duration of hysterectomy, family history of osteoporosis, serum calcium level, mean calorie intake, mean protein intake and comorbidities like diabetes mellitus, hypertension, hypothyroidism. With increase in Age, low socioeconomic status, increase in years since menopause and duration of hysterectomy the bone mineral density decreases.

With decrease in BMI, bone mineral density also decreases .

The Osteoporosis and Osteopenia prevalence were found to be high and alarming in postmenopausal women due to dietary and lifestyle risk. The study indicated that majority of the postmenopausal women predisposed to low BMD and osteoporosis are under diagnosed or under treated in this population. Based on these outcomes, there is a strong requirement for proper screening programs for postmenopausal women of this population so that preventive strategies can be effectively utilized by women at high risk. It is also advised that adequate management to be commenced at an early stage for women suffering from this condition in order to decrease morbidity and mortality. Nevertheless, the results of this study offer credibility to present recommendations for health care providers as an alert that Osteoporosis may be found in postmenopausal females and it may lead to increased risk of fracture. Hence, there is an urgent call for superior public understanding and awareness in this regard.

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