“PREVALENCE OF OSTEOPOROSIS AMONG POPULATION AGED ABOVE 40 YEARS IN SELECTED URBAN AREAS OF BELAGAVI - A CROSS SECTIONAL STUDY.”

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Endorsement by the Head of Department, Principal / Head of the Institution

This is to certify that the dissertation entitled **"PREVALENCE OF OSTEOPOROSIS AMONG POPULATION AGED ABOVE 40 YEARS IN SELECTED URBAN AREAS OF BELAGAVI - A CROSS SECTIONAL STUDY."** is a bonafide and genuine research work done by **(REG.NO. BD0114001).**

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INTRODUCTION

Osteoporosis is a growing health problem recognized in both developed and developing countries associated with substantial morbidity and socio-economic burden worldwide. The term osteoporosis is used without a clear indication of its meaning. It may describe clinical end result that is fracture and the process that gives rise to it.[1]

Osteoporosis is defined as "a systemic skeletal disease characterized by low bone mass and micro-architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture".[2, 3]

Basic mechanisms responsible for development of osteoporosis are poor bone mass acquisition during growth and development and accelerated bone loss in the period after peak bone mass is achieved. Both processes are modulated by environmental and genetic factors. [4]

About two thirds of the risk for fracture in postmenopausal women is determined by premenopausal peak bone mass. Peak bone mass is higher in blacks than in whites and Asians, and it is higher in men than women. Approximately half of the bone mass is accumulated during pubertal development. This is associated with the increase in sex hormone levels and is almost completed with closure of the end plates. There is only minimal additional accumulation of the bone minerals during the next 5 to 15 years (skeletal consolidation). Peak bone mass is achieved during the third decade of life. [4]

Studies in twins and mother-daughter pairs suggest that 40% to 80% of the variability in the bone mass is determined by genetic factors. The genes implicated in osteoporosis include those for the estrogen receptor, transforming growth factor- , and apolipoprotein E and collagen.[4]

Bone loss, in contrast, appears to be mostly determined by environmental factors (nutritional, behavioral, and medications). However, genetic factors also play a role, mostly acting on a person's estrogen status.[4]

The diagnosis of osteoporosis is based on bone mineral density (BMD) measurements and is defined by the World Health Organisation (WHO) criteria as: [2]

1. Normal BMD value within 1 S.D. of young-adult mean (T-score at or above -1)
2. Osteopenia BMD value between -1 S.D. and -2.5 S.D. below young-adult mean (Tscore between -1 and -2.5)
3. Osteoporosis BMD value at least -2.5 S.D. below young adult mean (T-score at or below -2.5).

Osteoporosis is recognized as a world-wide health problem and in India. It has become more common for medical practitioners to see post-menopausal women and older people suffering from osteoporotic fractures.[5] About 30–50% of women and 15–30% of men suffer from osteoporosis-related fractures in their lifetime.[6] Estimates indicate that the number of osteoporotic hip fractures occurring in the world will rise from 1.66 million to 6.26 million by the year 2050, thereby implying an urgent need for preventive strategies. Projections indicate that by the year 2050, 45% of osteoporotic fractures will occur in Asia.[1, 2.]

The world's Osteoporosis—"Time Bomb" is ticking, with projected global burden of osteoporosis hip fractures expected to exceed six million by 2050.[7]

In western countries the peak incidence of osteoporosis occurs at about 70-80 years of age, in India it may afflict those 10-20 years younger, at age 50-60.[8]

A group of experts in 2003 suggested that 26 million Indians suffer from osteoporosis, the number projected to increase 36 million by 2015 and making India one of the largest affected countries in the world.[9]

Osteoporosis, which literally means "porous bone", is a disease in which the density and quality of bone are reduced. The loss of bone occurs "silently" and progressively. Often there are no symptoms until the first fracture occurs. [2]

It is the commonest metabolic bone disease in clinical practice and is a major public health problem as commonly it is underdiagnosed.[2] It therefore indicates that measurement of bone mineral density (BMD) is a central component to diagnosis of the disease.[10]

Osteoporosis is one among the five non-communicable diseases of aging. The treatment costs are more expensive after diabetes, hyper-lipidemia, hypertension and heart diseases. The incidence is increasing in developing countries as the longevity is increasing in these countries.[11]

The process of aging is associated with decreased calcium absorption from the gut, especially in postmenopausal women; thus, insufficient dietary calcium intake attributable to socioeconomic constraints and lack of awareness increases the risk of osteoporosis. [2]

Osteoporosis can be prevented and treated if diagnosed early and accurately. Unfortunately, it is often undiagnosed until a fracture occurs. Therefore, the number of people who are screened for this disease must be increased. Measuring bone mineral density (BMD) is the most important tool in the diagnosis of osteoporosis in the early stage of osteoporosis and provides a numerical estimate of an individual's bone mass.[12]

Eventhough the gold standard for measuring bone density is Dual Energy X-ray Absorptiometry (DEXA), the commonest used modality of measuring bone density still remains to be Calcaneal QUS (Quantitative Ultra Sonography) as it is cost effective, lacks deleterious effect of radiation and is portable, and therefore it can be useful for screening of osteopenia and osteoporosis.[13]

Similar studies using Calcaneal QUS evaluating bone density among population from within and outside India are present in the literature but still the data is scanty, particularly for this region.

Hence, the study was planned to screen bone density of urban population above age of 40 years by using Calcaneal QUS. Thus, for the prevention and control of osteoporosis, there is a great need in conducting epidemiologic surveys of the prevalence of osteoporosis and related risk factors in urban communities.

OBJECTIVES

The objectives of the present study were:

1. To assess the prevalence of osteoporosis among the population aged above 40 years in selected urban areas.
2. To know the risk factors associated with osteoporosis.

REVIEW OF LITERATURE

HISTORY OF OSTEOPOROSIS:

The link between age-related reductions in bone density and fracture risk goes back at least to Astley Cooper, and the term "osteoporosis" and recognition of its pathological appearance is generally attributed to the French pathologist, Jean Lobstein. The American endocrinologist, Fuller Albright linked osteoporosis with the postmenopausal state. [14]

Anthropologists have studied skeletal remains that showed loss of bone density and associated structural changes that were linked to chronic malnutrition in the agricultural area in which these individuals lived. It follows that the skeletal deformation may be attributed to their heavy labor in agriculture as well as to their chronic malnutrition, causing the osteoporosis seen when radiographs of the remains were made. [15]

Osteoporosis means "porous bones", from Greek: /*ostoun* meaning "bone" and /*poros* meaning "pore".

Related studies-

A cross sectional study was conducted in Maharashtra, India in 2010 on prevalence of osteoporosis and associated factors among the employees of a Trust included 264 subjects aged 21years and above. The Prevalence was found to be 28.03% while osteopenia was evident in 31.06% of study subjects. Significant association of osteoporosis was evident with risk factors like chronic diseases

(hypertension, diabetes, ischaemic heart disease etc.), lack of exercise, alcoholism/ smoking and positive family history.[16]

A cross sectional study was conducted in Tamil Nadu, India in 2010 for evaluation of osteoporosis in Indian women and men attending the screening camp. A total of 167 subjects (77 females and 90 males) were included in the study. Results showed that 31.8% of women aged 50 years or more were classified as having osteoporosis (T-score -2.6) while 36.4% were found to be at risk of osteoporosis (T-score between -1.5 and -2.5) and none of the male participants was found to have osteoporosis but 16.7% of men aged 50 years or more were classified as being at risk of osteoporosis.[5]

A cross sectional hospital based pilot study was conducted in the year 2010 for prevalence of osteoporosis and evaluation of its risk factors in surgical and natural postmenopausal women. Among the 35 study participants, 27 were natural postmenopausal women (NPMW), 8 were surgical postmenopausal women (SPMW). The prevalence of osteoporosis among NPMW and SPMW was 44.82% and 37.5% respectively and associated factors like Mean BMI of NPMW was 26 ± 2.76 and SPMW was 24.61 ± 6.25 and the mean BMD was 753.36 ± 176.2 g/cm2 and 973.2 ± 108.28 g/cm2 respectively.[17]

A cross sectional community based descriptive study was undertaken to study prevalence of osteopenia and osteoporosis and its correlation with epidemiological and socio-behavioral factors amongst dependant women above age of 35 yrs. The study was carried out during the camp in 2010 for estimation of BMD and a total of 194 women attended the camp. The prevalence of osteoporosis and osteopenia was found to be 13.3% ± 5.29% and 48.1% ± 7.79% respectively.[18]

A cross sectional hospital based study was conducted in 2011 at Chitwan, India for prevalence of osteoporosis among middle aged women. A total of 200 women participated in the study. Out of 200 respondents, 65.5 percents respondents had low bone mineral density (osteopenia and osteoporosis). According to WHO criteria 26.2% were identified as osteoporosis, 39.3% were osteopenia and 34.4% had normal BMD at wrist site.[19]

A study conducted in Guilan, Iran where, Seven hundred and six women aged 50-75 years old were randomly recruited from urban (n = 440) and rural (n = 266) areas. They found that the prevalence of osteoporosis was significantly greater among women with low educational level 18.0% than women with high educational status 3.8% ($P < 0.0001$). However, women with low educational level had higher mean serum level of vitamin D than women with high educational level. Osteoporosis was significantly more prevalent among women living in rural areas (19.1%) than women living in urban areas (13.3%).[20]

A study done in New Delhi, India to evaluate prevalence of osteoporosis using Quantitative Ultrasound for menopausal women in rural and urban area. In this study 1136 women aged 40 to 60 years using calcaneal quantitative ultrasound reported prevalence of osteoporosis to be 15% among premenopausal women. The crude prevalence of osteoporosis was higher in the urban areas compared with the rural areas. By contrast, in postmenopausal women osteoprosis was more in women in rural areas than in urban areas. [21]

In a study which screened 158 urban women from Jammu using calcaneal QUS, the incidence of osteoporosis was (20.25%) and osteopenia (36.79%) with maximum number of both osteoporosis and osteopenic women recorded in the age

group of 55- 64 years. After the age of 65 years, there was an almost 100% incidence of either osteopenia or osteoporosis. Religion, caste and diet also had an influence on the outcome of osteopenic and osteoporosis score. [22]

In a study done in semi urban region of south India to know the prevalence of osteoporosis by calculating BMD in ambulatory post menopausal of 150 sample size using a DEXA Scan and its relationship to calcium nutrition and vitamin D status showed that the prevalence of osteoporosis was 48% at lumbar spine level, 16.7% at femoral neck it was and 50% at any site.[23]

Another study done among elderly women living in Delhi and rural Haryana to know the prevalence of osteoporosis showed that the prevalence of osteoporosis was 53% from Delhi and 76 % from Haryana. They also concluded there was no significant difference in height or menopausal age in relation to the prevalence but there was a significant difference in BMI (26.95 vs. 21.6).[24]

A study done to assess the prevalence and relative importance of risk factors for low bone mass in urban Indian women above 40 years of age showed that BMD at all three sites of measurement (Spine, Hip & wrist) was significantly lower in post menopausal than in pre menopausal women. Prevalence of osteoporosis was highest at the lumbar spine (25.8%) in post menopausal women, while prevalence of osteopenia was high in pre menopausal women (44.3%). Vitamin D deficiency was seen in 54.5% of pre menopausal and 41.8 % post menopausal women. Correlation between sun index and lumbar spine BMD was marginally significant.[25]

A study was done to assess bone status of Indian women from a low income group and its relationship to nutritional status using DEXA Scan showed the

prevalence of osteoporosis at the femoral neck was around 29%. BMD at all skeletal sites and whole body increased significantly with increasing body weight and BMI of women. Apart from body weight, age, menopause and calcium intake were other important determinants of BMD.[26]

In a study conducted in Delhi to assess bone health in healthy Indian population aged 50 years and above evaluated One thousand six hundred healthy subjects showed that osteoporosis was present in 35.1% subjects and osteopenia in 49.5%. Bone mineral density (BMD) correlated positively with body mass index (BMI) and negatively with Paratharmone (PTH) levels.[27]

A study to assess bone mineral density in women more than 40 years of age found that osteopenia was found in 31.4% subjects and osteoporosis in 14.3% subjects. Increasing age and time since menopause was associated with increased risk of osteoporosis. Age at menarche, lactation, and exercise were not found to be statistically significant as risk factors. Women from the lower socioeconomic strata had a significantly higher percentage of osteopenia and osteoporosis. BMD was higher in obese women, but the difference between this group and those with normal BMI did not achieve statistical significance. [28]

A study to determine bone mineral status in immigrant Indo-Asian women and to compare the bone mineral at the lumbar spine and femoral neck of Indo-Asian immigrant women with that of age-matched caucasian women concluded that Indo-Asian women appear to have lower spinal BMD than caucasians, these differences disappear when BMAD values are calculated.[29]

METHODOLOGY

The study was carried out among the population aged above 40 years in selected urban areas of Belagavi.

Study design:

Community based Cross-Sectional Study.

Source of data:

Population aged above 40 years residing in areas covered by 3 Urban Health Centres (UHC's) - Rukmini Nagar, Ashok Nagar and Ram Nagar which are under field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College,Belagavi.

Study Area:

To assess the prevalence of osteoporosis, study participants were selected from the areas covered by 3 UHC's – Rukmini Nagar, Ashok Nagar and Ram Nagar.

Selection of Study Participants:

Participants residing for more than one year in these areas aged above 40 years were included and informed consent was obtained.

Study period:

1st January 2015 to 31st December 2015.

Sample size:

Calculated using the formula

$n = (1.96)^2 pq/d^2$

n - sample size

p – 28% (prevalence of Osteoporosis)[16]

q - 72% (100-p)

d – absolute error 15% of p , i.e. 15% of 28 is 4.2

$$n = \frac{(1.96)^2 \times 28 \times 72}{(4.2)^2}$$

$= 439$

Corrected sample size: **450**

Therefore 450 participants of both sexes from areas covered by 3 UHC's included in the study.

Sample Selection:

Population covered by Ram Nagar, Ashok Nagar and Rukmini Nagar UHC's was 32,815; 31,933 and 43,600 respectively. As per SRS 2010, 26.2% of the population has people aged above 40 years.[30] Hence, the population aged above 40 years in Ram Nagar, Ashok Nagar and Rukmini Nagar when calculated to be 8,597 ; 8,366 and11,423 respectively. The total study sample of 450 participants was collected from each of the centres in the ratio 3:3:4. Thus, by Probability Proportionate to size sampling 135 participants from Ram Nagar and Ashok Nagar and 180 participants from Rukmini Nagar was chosen by Simple Random sampling.

SELECTION CRITERIA

Inclusion Criteria:

a) Population above 40 years of both sexes.

b) Permanent residents of study area for more than one year.

Exclusion Criteria:

a) Persons with severe disability

b) Persons having paralysis and

c) Chronic debilitated patients

Thus as per inclusion and exclusion criteria, 450 study participants aged above 40 years of both sexes were screened between 1st January 2015 to 31st December 2015 were included in the study.

Data Collection:

A house to house visit was made and predesigned and pretested questionnaire was used to collect data. The bone density estimation was performed by scanning in all the participants by using Bone Densitometry (Calcaneal Quantitative Ultrasound) scan in selected UHC's coming under field practice area of Dept. of Community Medicine, Jawaharlal Nehru Medical College, KLE University, Belagavi. Also, clinical examination was done in all the study participants.

Questionnaire included socio-demographic details such as age, sex, address, educational status, main work status (occupation), marital status, socio-economic status, menopausal history, obstetric score, history of diabetes mellitus and hypertension, family history, personal habits, dietary habits, etc.

Personal interview was conducted in their local language (Kannada/Marathi) for ease of understanding and positive response from the subject, using the pretested questionnaire. The information related to the socio-demographic, economic, personal, reproductive aspects and life style was collected from study participants. Adequate time was given to each study subjects. Patient's comfort was maintained during the interview. The data was collected after obtaining the informed consent in their local language, in the presence of an eye witness.

Data analysis:

The collected data was entered in Microsoft Excel 2007 and analyzed by using SPSS 20 statistical software. Exposure to various risk factors in study participants was found out existence and association between the risk factors and osteoporosis.

The association and relationship between the osteoporosis was analyzed by using chi-square test. Statistical significance was considered when p value was less than 0.05 at 95% confidence interval.

Ethical Clearance:

The present study was approved by J. N. Medical College Institutional Ethics Committee on Human subjects' Research. (Ref: MDC/DOME/102 dated 14/11/2014-Annexure I)

Definition of study variables:

Age: Age was recorded to the nearest completed years.

Religion: The participants religion was noted and was grouped as "Hindu", "Muslim", "Christian" and "Others" (Jain, Buddhist, Parsi, etc).

Educational status: The participants were asked about their highest level of completed education and were grouped into following categories:

1. **Illiterate**: Participants who cannot read and write.
2. **Primary school**: Participants who has studied from first to seventh standard.
3. **High school**: Participants who has studied eighth to tenth standard.
4. **Pre-university**: Participants who has studied up to Pre-University College.
5. **Graduate:** Participants who has studied up to College.
6. **Post-Graduate:** Participants who has studied up to Masters/Diploma.

Occupation: Each study participant was asked about her major occupation. This information was collected and grouped as follows:-

1. **Housewife:** Woman who takes care of the day to day household duties without being paid.
2. **Unemployed:** Participants who don’t have work/job.
3. **Unskilled workers:** Participants who work with minimal/no skill with low wages.
4. **Skilled workers:** Participants who work with skilled qualities and get high wages.
5. **Business:** Participants who have their own business e.g,: shop, trading, etc.
6. **Professional workers:** Participants who are highly educated and work with their professional status.

Marital Status: Marital status was classified as “Married”, “Unmarried” and “Widowed/widower”.

Type of Family:

1. **Nuclear family**: The family consisting of married couple along with their dependent children.
2. **Joint family**: It consists of more than one married couple and their children who live in the same household.

Socio-economic status: Information regarding per capita income (in Rupees / month) was collected and socio-economic status was classified using Modified B. G. Prasad's classification for the study period (2015). [31]

Socio-Economic Class	Prasad's classification 1961 (per capita income in Rupees/month)	Modified Prasad's classification 2015 (per capita income in Rupees/month)
I	100 and above	5965 and above
II	50-99	2983-5964
III	30-49	1789-2982
IV	15-29	895-1788
V	<15	Below 895

$$\text{Monthly Per Capita Income} = \frac{\text{Total monthly income of family}}{\text{Total members of family}}$$

Modification was done with the aid of Correction factor (CF), which was obtained as below:

As our study period was from 1st January 2015 to 31st December 2015, the mean consumer price index for the period was considered.

Average consumer price index for year 2015 was 1210. [32]

$$CF = \frac{\text{Value of consumer price index average for the study period (2015)}}{100} \times 4.93$$

$$= \frac{1210 \times 4.93}{100} = 59.65$$

Modified B. G. Prasad classification = Per capita family monthly income of 1961 x CF

Diet: It includes type of diet i.e. Vegetarian or Mixed diet.

Menstruation history:

1. **Not attained menopause**
2. **Attained menopause**
3. **Hysterectomy done**

Menopause means – physiologically complete stoppage of menstrual cycle.

Gravida status: Number of times a women has become pregnant, regardless of whether the pregnancies were interrupted or resulted in a live birth.

Lifestyle means: The way participants live, reflecting a whole range of social values, attitudes and activities.

Diabetes mellitus: Participants who are already diagnosed as diabetes (fasting blood glucose >110 mg/dl, post prandial >200 mg/dl) since how many years.

Hypertension: Participants who are already diagnosed as hypertension (systolic blood pressure >140 mm Hg, diastolic blood pressure >90 mm Hg) since how many years.

Alcohol consumption: Weather the participants is alcoholic or not? If alcoholic, since how many years the participant is consuming alcohol? Quantity of alcohol consumed per day? If quitted, since how many years?

Smoking status: Weather the participants is a smoker or not? If the participant is smoking, since how many years? Number of cigarettes/beedi per day? If quitted, since how many years?

Family history of Osteoporosis: Anyone of first degree relative had been diagnosed with Osteoporosis.

Previous history of Fractures: Participants had fractures in the past.

History of Recurrent Fractures: Participants had fractures more than or equal to three times after 40 years of age.

Height: Participants were asked to stand straight without footwear, with heels, buttocks and back straight and arms hanging by side. The height was measured from head to heel. The coinciding reading was measured to the nearest 0.1 cm using a metallic measuring tape.[33]

Weight: Participants were asked to stand straight without footwear, with heels, buttocks and back straight and arms hanging by side. The weight was measured using standard weighing scale.[33]

Calculation of Body Mass Index (BMI in Kg/m^2): Body mass index was calculated as:

$$\textbf{BMI} = \frac{\text{weight in Kgs}}{(\text{height in metre})^2}$$

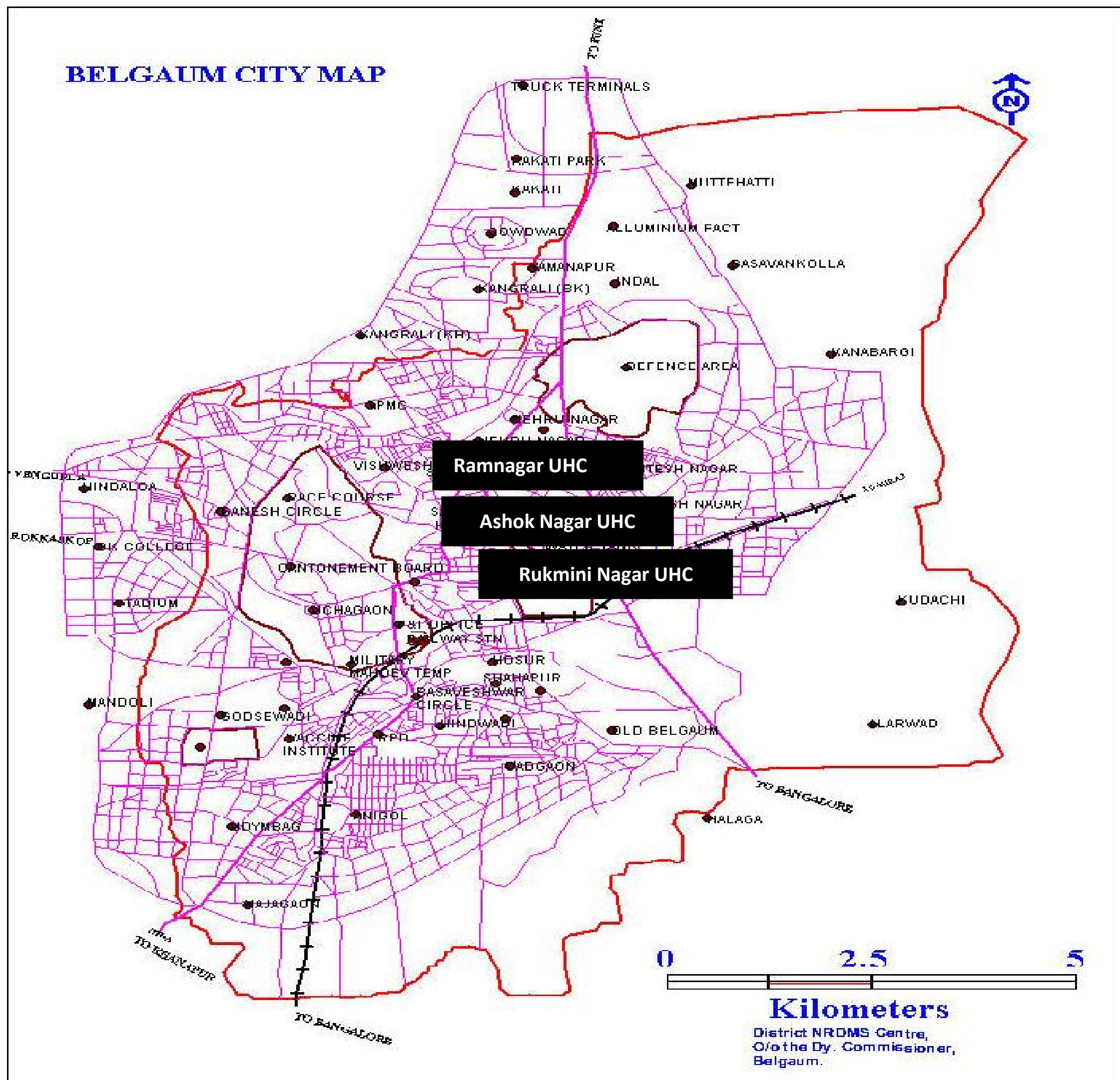
Based on WHO and International obesity task force (IOTF), BMI cut-off standards for Asia and India, obesity was defined as below [34] :

Body Mass Index	Interpretation
< 18.5	Underweight
18.5-22.9	Normal weight
23-24.9	Overweight
≥ 25	Obese

Bone Mineral Density (BMD): Defined by the World Health Organization (WHO) criteria as: [2]

1. Normal BMD value within 1 S.D. of young-adult mean (T-score at or above -1)
2. Osteopenia BMD value between -1 S.D. and -2.5 S.D. below young-adult mean (T-score between -1 and -2.5)
3. Osteoporosis BMD value at least -2.5 S.D. below young adult mean (T-score at or below -2.5).

Map-1: Map of Belagavi city showing urban areas Ashok Nagar, Ram Nagar and Rukmini Nagar.



Introduction

Objectives

Review of Literature

Methodology

Results

Discussion

Conclusion

Summary

Bibliography

Annexure-I

Annexure-II

Annexure-III

Annexure-IV

Annexure-V

RESULTS

The present study was conducted in Urban Health Centres, Ashok nagar, Ram nagar, Rukmini nagar which is the field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, KLE University, Belagavi.

The data obtained was tabulated and analyzed under the following headings:

1. **SOCIO-DEMOGRAPHIC PROFILE OF STUDY PARTICIPANTS**
2. **DISTRIBUTION OF THE STUDY PARTICIPANTS ACCORDING TO THEIR RISK FACTORS OF OSTEOPOROSIS.**
3. **PREVALENCE OF OSTEOPOROSIS BY USING CALCANEAL ULTRASOUND ON STUDY PARTICIPANTS**
4. **ASSOCIATION BETWEEN RISK FACTORS OF OSTEOPOROSIS AND OSTEOPOROSIS ON STUDY PARTICIPANTS.**

1. SOCIO-DEMOGRAPHIC PROFILE OF STUDY PARTICIPANTS

Table 1: Distribution of study participants according to Age groups (n=450).

Age Category	Male	Female	Total
40-49 years	65(44.8%)	125(41.0%)	190 (42.2%)
50-59years	34 (23.4%)	78 (25.6%)	112 (24.9%)
60-69 years	29 (20.0%)	80 (26.2%)	109 (24.2%)
70-79 years	17 (11.7%)	18 (5.9%)	35 (7.8%)
80-89 years	0 (0.0%)	04 (1.3%)	04 (0.9%)
Total	145 (100%)	305 (100%)	450 (100%)

Of the 450 study participants, most of them 190 (42.2%) belonged to the age group of 40 – 49 years followed by 112 (24.9%) were in the age group of 50 – 59 years, 109 (24.2%) were 60 – 69 years, 35 (7.8%) were 70 – 79 years, remaining 04 (0.9%) were in the age group of 80 – 89 years. Mean age and standard deviation of the male participants was 53.8 ± 10.59 with a minimum age of 40 years and a maximum age of 76 years, similarly in female participants the mean of age and standard deviation was 53.9 ± 9.90 with a minimum age of 40 years and maximum age of 81 years. The combined mean and standard deviation of the age was 53.9 ± 10.12.

Graph 1: Distribution of study participants according to Age groups

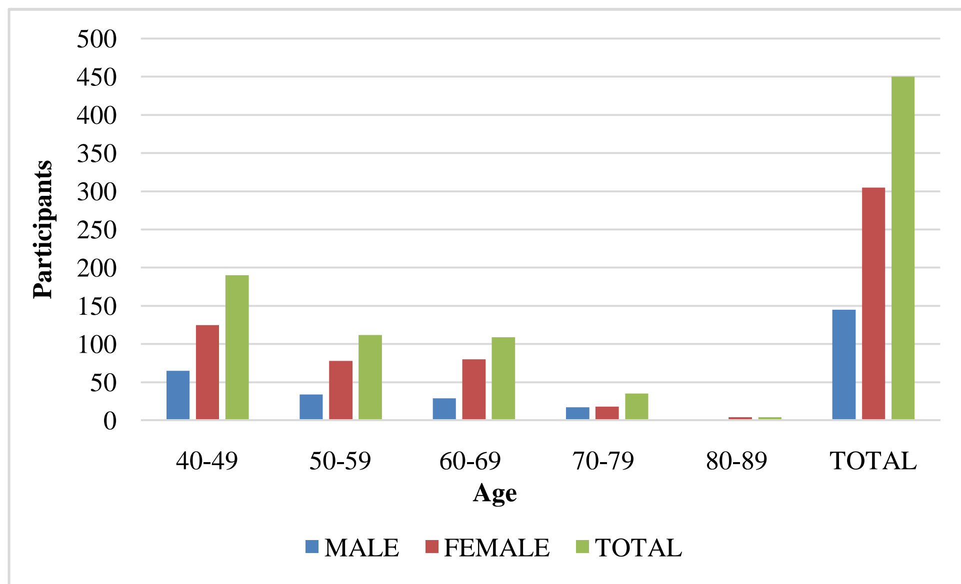


Table 2: Distribution of study participants according to sex (n=450)

Sex	Participants	Percentage
Male	**145**	**32.2%**
Female	**305**	**68.8%**
Total	**450**	**100%**

Out of the total 450 participants in our study, most 305 (68.8%) of them were females and 145 (32.2%) were males.

Graph 2: Distribution of study participants according to sex

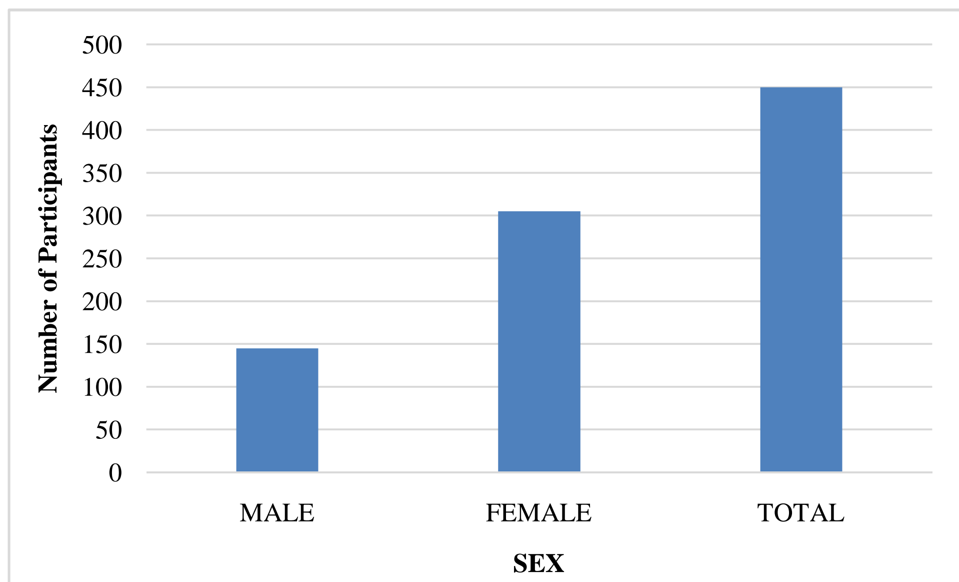


Table 3: Distribution of the study participants according to their religion (n=450).

Religion	Participants	Percentage
Hindu	277	61.6%
Muslim	154	34.2%
Christian	10	2.2%
Others	09	2.0%
Total	450	100%

Majority of the study participants were Hindus (61.6%) followed by Muslims (34.2%), Christian (2.2%) and least were others religions (2.0%).

Graph 3: Distribution of the study participants according to their religion

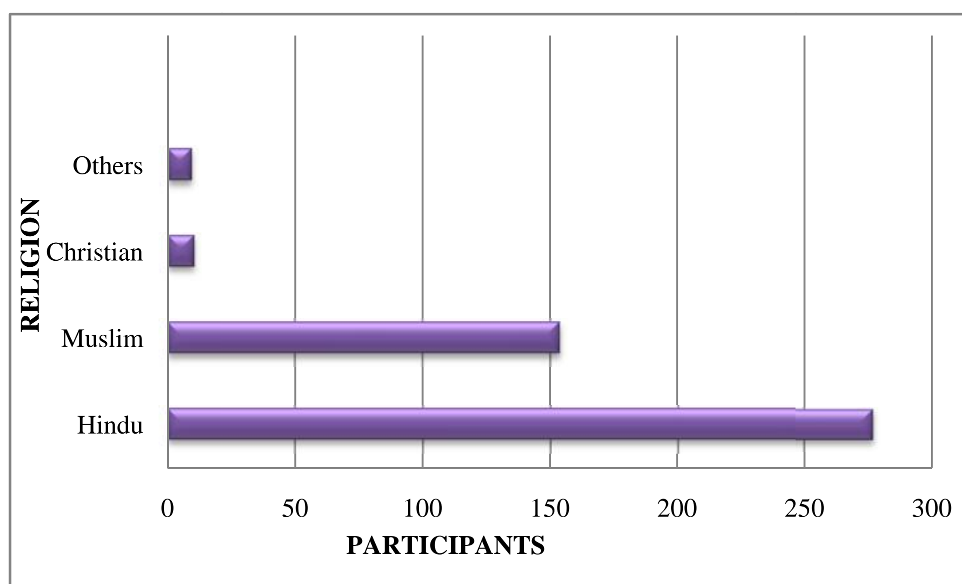


Table 4: Distribution of study participants according to education status (n=450):

Education	Male	Female	Percentage
Illiterate	22 (15.2%)	122 (40.0%)	144 (32.0%)
Primary	18 (12.4%)	57 (18.7%)	75 (16.7%)
Secondary	43 (29.7%)	60 (19.7%)	103 (22.9%)
Pre-University/Diploma	30 (20.7%)	48 (15.7%)	78 (17.3%)
Graduation	08 (5.5%)	11 (3.6%)	19 (4.2%)
Post-Graduation	24 (16.6%)	07(2.3%)	31(6.9%)
Total	145 (100%)	305 (100%)	450 (100%)

Among the study participants, 144(32.0%) were illiterate followed by secondary school 103(22.9%), PUC/ Diploma 78(17.3%), primary school 75(16.7%), post-graduation 31(6.9%) and graduation 19(4.2%). Majority of males 43(29.7%) had studied upto secondary school and most of the females were illiterate 122(40.0%).

Graph 4: Distribution of study participants according to education status

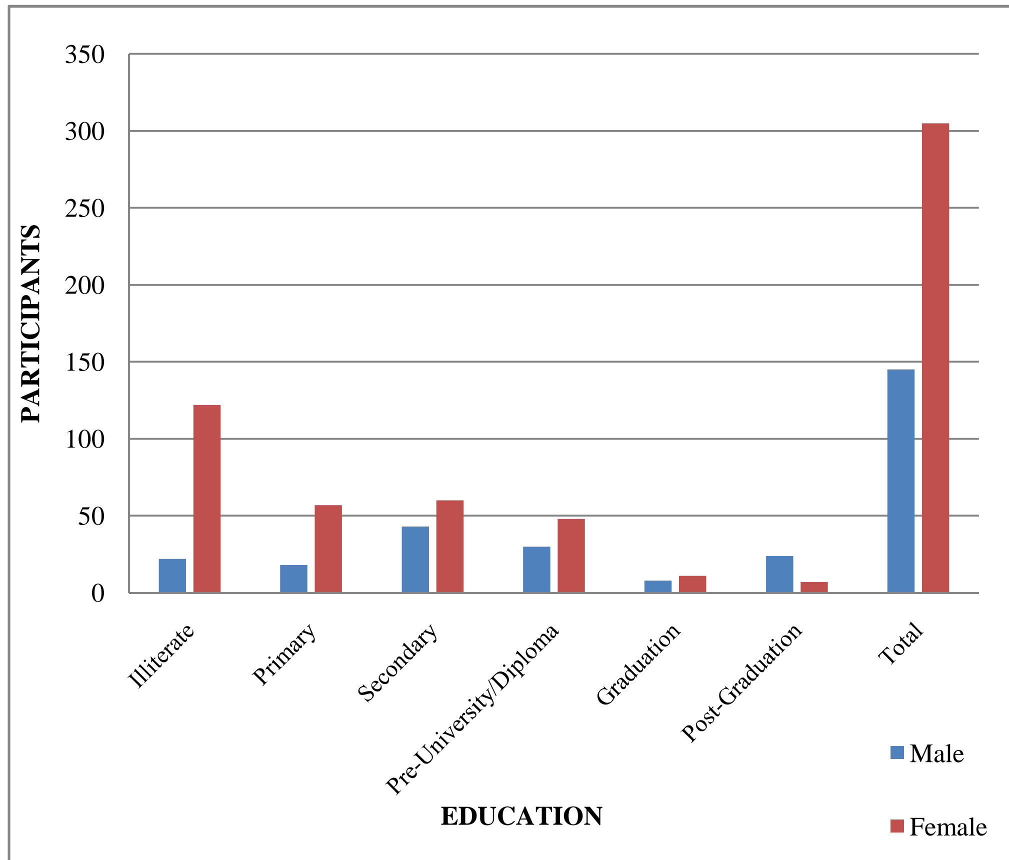


Table 5: Distribution of the study participants according to their occupation (n=450):

Occupation	Male	Female	Percentage
Housewife	0 (0.00%)	205 (67.2%)	205 (45.6%)
Unemployed	31 (21.4%)	10 (3.3%)	41 (9.1%)
Unskilled worker	23 (15.9%)	37 (12.1%)	60 (13.3%)
Skilled worker	44 (30.3%)	03 (1.0%)	47 (10.4%)
Business	11 (7.6%)	32 (10.5%)	43 (9.6%)
Professional worker	36 (24.6%)	18 (5.9%)	54 (12.0%)
Total	145 (100%)	305 (100%)	450 (100%)

Majority 205(45.6%) were housewives followed by unskilled workers 60(13.3%), Professional workers 54(12.0%), Skilled workers 47(10.4%), Business 43(9.6%) and Unemployed 41(9.1%). Majority of males were Skilled workers 44(30.3%) and females were housewives 205(67.2%).

Graph 5: Distribution of the study participants according to their occupation

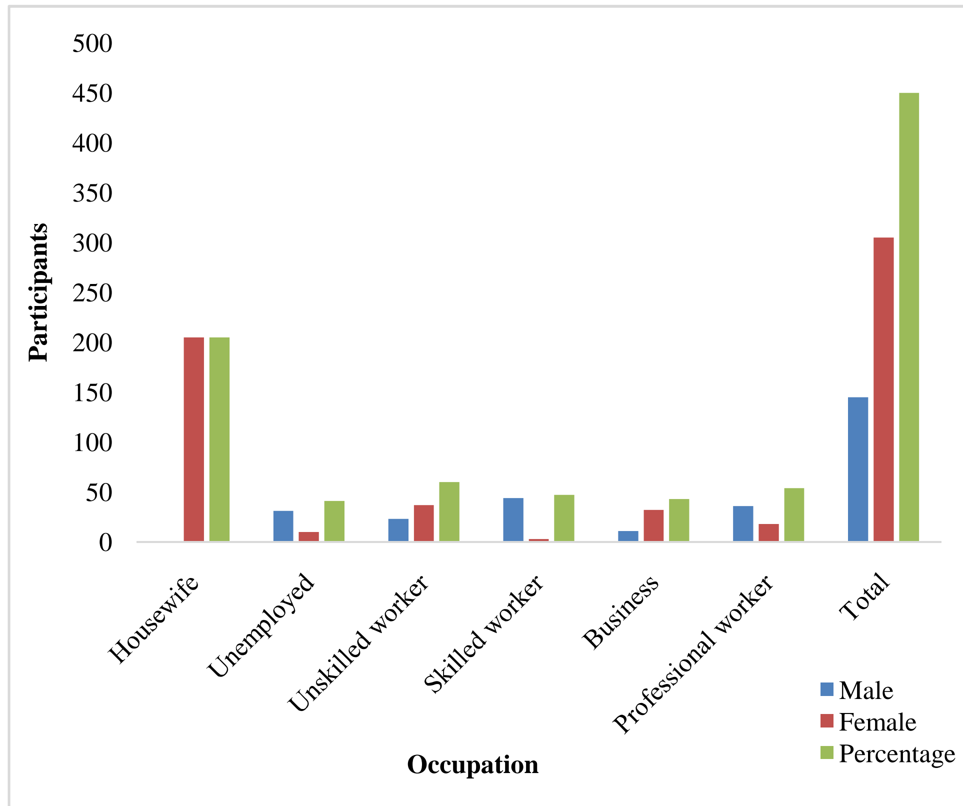


Table 6: Distribution of Study participants according to their marital status (n=450):

Marital status	Number	Percentage
Unmarried	04	0.9%
Married	381	84.7%
Widowed/ widower	65	14.4%
Total	450	100%

In our study majority were Married (84.7%) followed by Widowed/ widower (14.4%) and few were unmarried (0.9%).

Graph 6: Distribution of Study participants according to their marital status

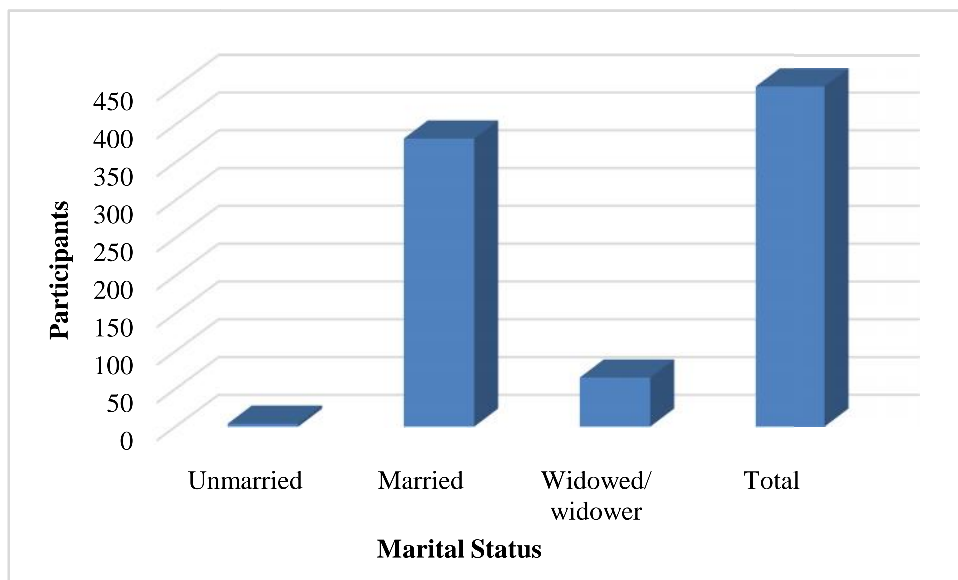


Table 7: Distribution of Study participants according to the type of family (n=450):

Type of Family	Participants	Percentage
Joint	131	29.1%
Nuclear	319	70.9%
Total	450	100%

Out of 450 participants, majority belonged to nuclear family (70.9%) and the rest of them belonged to joint family (29.1%).

Graph 7: Distribution of Study participants according to the type of family

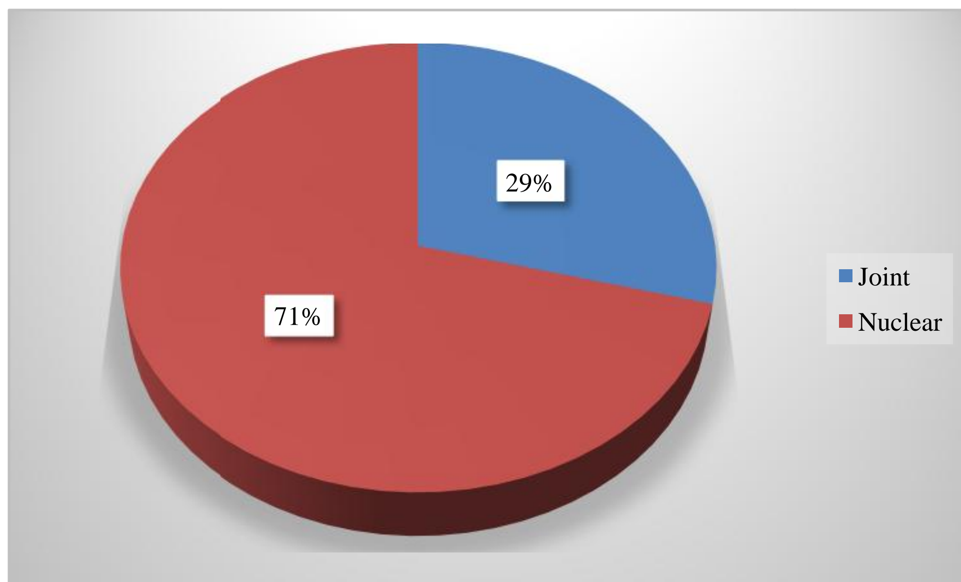


Table 8: Distribution of study participants according to socio economic status (Modified B. G. Prasad classification) (n=450):

B.G Prasad Class Status	Number	Percentage
Class I	53	11.8%
Class II	92	20.4%
Class III	114	25.3%
Class IV	123	27.3%
Class V	68	15.1%
Total	450	100%

In our study, most of them belonged to Class IV (27.3%) followed by Class III (25.3%), Class II (20.4%), Class V (15.1%) and the rest belonged to Class I (11.8%)

Graph 8: Distribution of study participants according to socio economic status (Modified B. G. Prasad classification)

2 RISK FACTORS OF OSTEOPOROSIS ON STUDY PARTICIPANTS

Table 9: Distribution of the study participants according to their diet patterns (n=450):

Diet Pattern	Number	Percentage
Vegetarian	139	30.9%
Mixed	311	69.1%
Total	450	100%

In our study, 311 (69.1%) study participants were mixed diet and about 139(30.9%) were vegetarian.

Graph 9: Distribution of the study participants according to their diet patterns

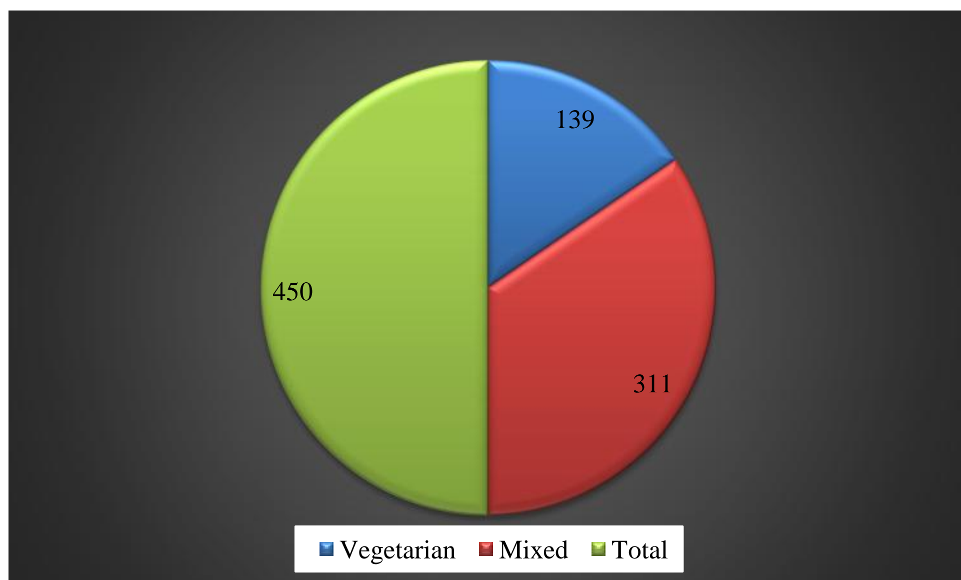


Table 10: Distribution of the female study participants according to their menopausal status (n=305):

Menopausal status	Number	Percentage
Yes	229	75.1%
No	59	19.3%
Hysterectomy	17	5.6%
Total	305	100%

In our study, among 305 female study participants, 229 (75.1%) had attained menopause and 59 (19.3%) had not attained yet attained menopause. Seventeen (5.6%) female participants had hysterectomy.

Graph 10: Distribution of the female study participants according to their menopausal status

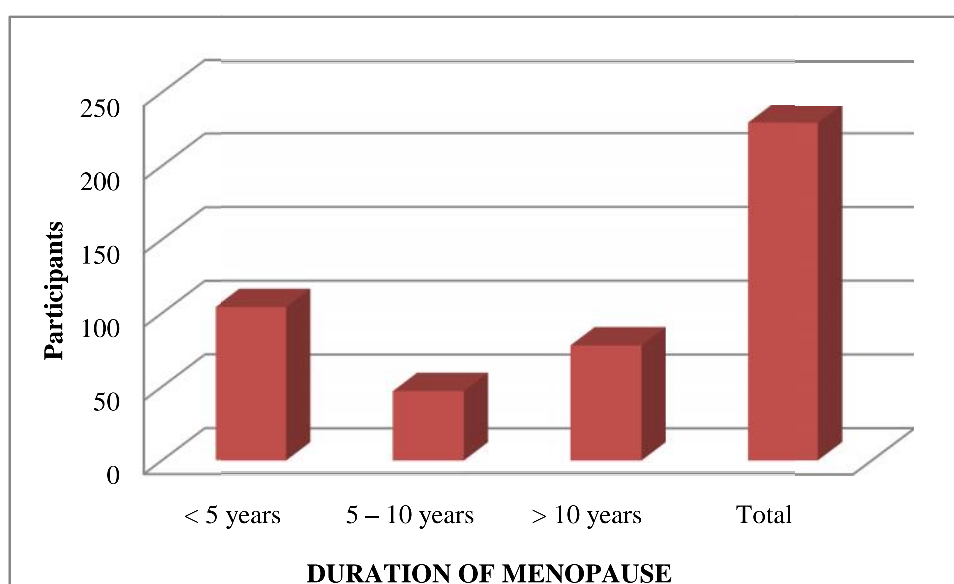


Table 11: Distribution of the female study participants according to the duration since menopause (n=229):

Duration since menopause	Number	Percentage
< 5 years	104	45.4%
5 – 10 years	47	20.5%
> 10 years	78	34.1%
Total	229	100%

Among 229 female study participants who attained menopause, 104 (45.4%) participants had menopause was less than five years, followed by 78 (34.1%) who had menopause for more than 10 years and 47(20.5%) was between five to ten years.

Table 12: Distribution of the female study participants depending on Gravida status (n=305):

Gravida status	Participants	Percentage
One	57	18.7%
Two	244	80.0%
Nil	04	1.3%
Total	305	100%

Among 305 female study participants, majority of them 244 (80.0%) had two or more children followed by 57 (18.7%) with one child, and 04(1.3%) with no children.

Graph 11: Distribution of the female study participants depending on Gravida status

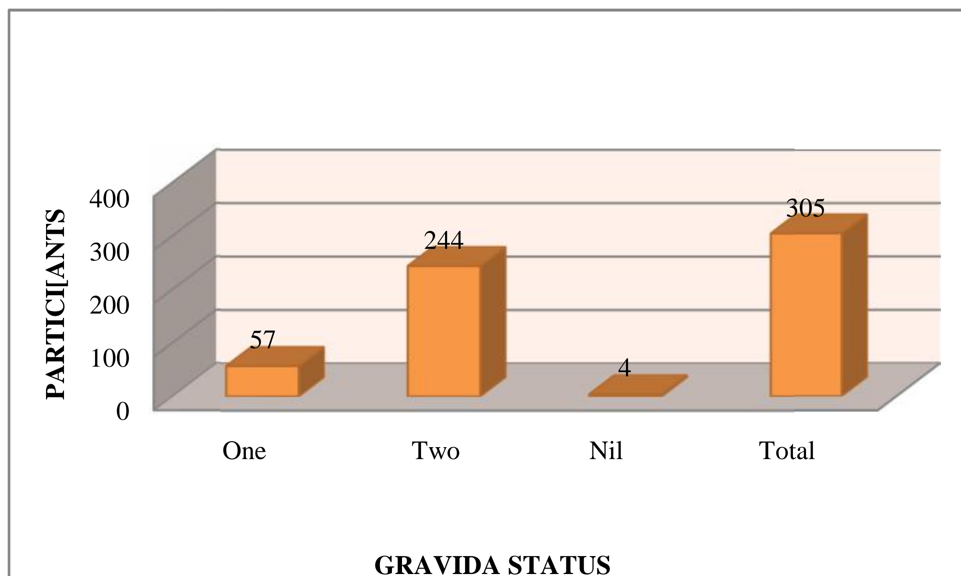


Table 13: Distribution of the study participants according to life style (n=450):

Life style	Male	Female	Total
Active	65 (44.8%)	128 (42.0%)	193 (42.9%)
Sedentary	80 (55.2%)	177 (58.0%)	257 (57.1%)
Total	145(100%)	305(100%)	450(100%)

Of the 450 study participants, majority 257 (57.1%) belonged to sedentary life style and rest 193 (42.9%) belonged to active life style.

Graph 12: Distribution of the study participants according to life style

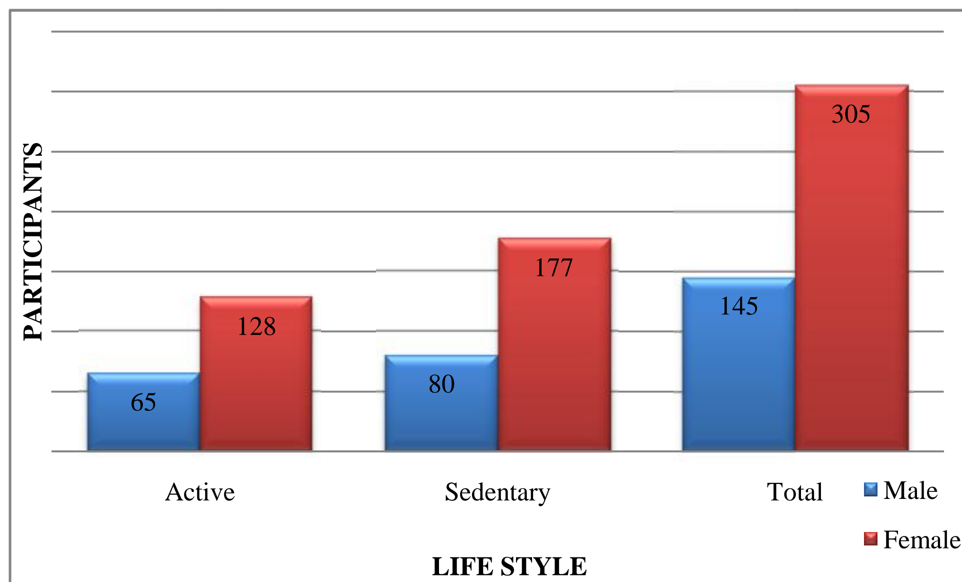


Table 14: Distribution of the study participants according to Diabetes Mellitus status (n=450):

Diabetes Mellitus	Number	Percentage
Yes	107	23.8%
No	343	76.2%
Total	450	100%

Among 450 study participants, 343 (76.2%) were free from diabetes and 107 (23.8%) had diabetes.

Graph 13: Distribution of the study participants according to Diabetes Mellitus status

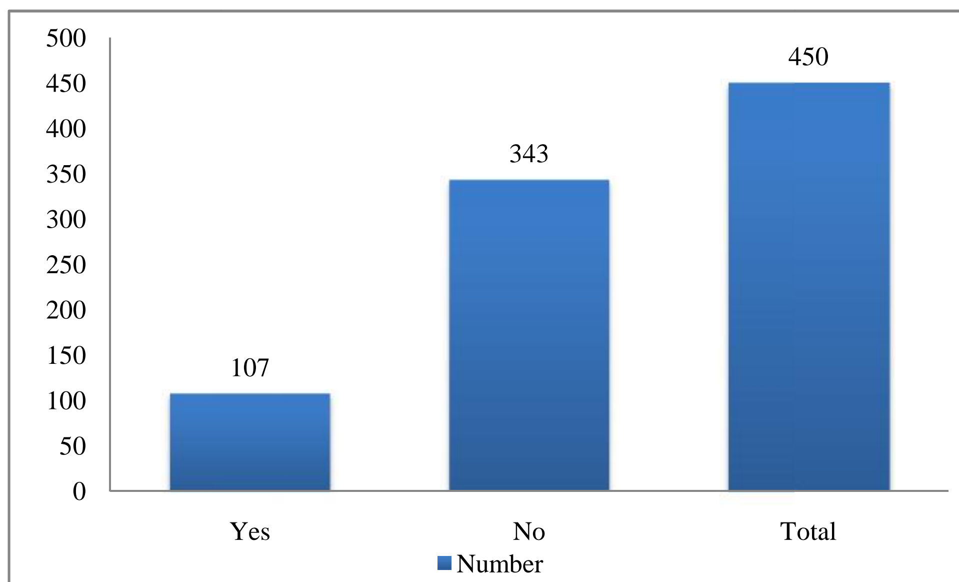


Table 15: Distribution of the study participants depending on duration of Diabetes Mellitus (n=107):

Duration of Diabetes Mellitus	Number	Percentage
< 5 years	54	50.5%
5 – 10 years	41	38.3%
> 10 years	12	11.2%
Total	107	100%

Among 107 diabetic study participants, most of the participants 54 (50.5%) had diabetes for less than five years, followed by 41(38.3%) between five to ten years and 12 (11.2%) for more than 10 years.

Table 16: Distribution of the study participants according to Hypertension status (n=450):

Hypertension	Number	Percentage
Yes	180	40.0%
No	270	60.0%
Total	450	100%

Among 450 study participants, 270 (60.0%) were not hypertensive and 180 (40.0%) had hypertension.

Graph 14: Distribution of the study participants according to Hypertension status

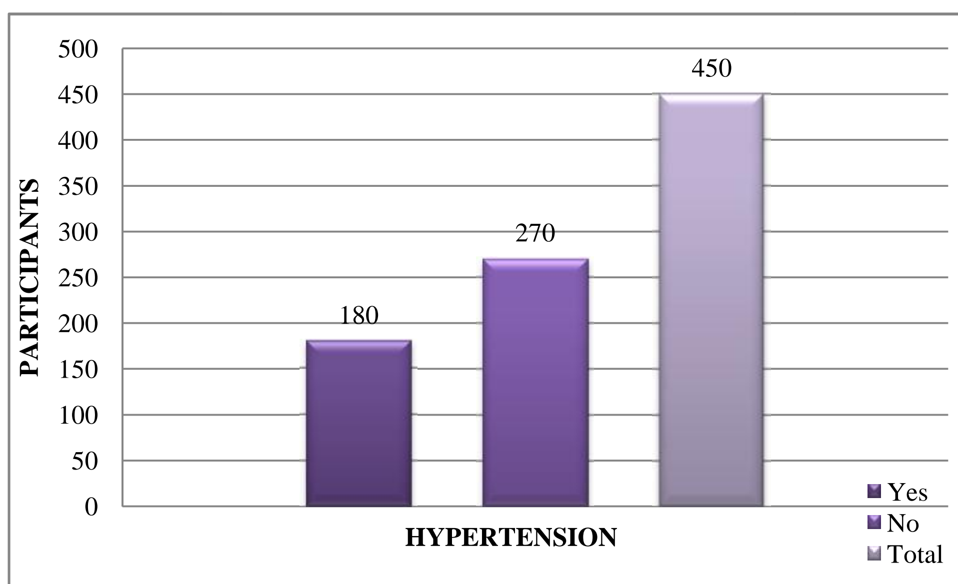


Table 17: Distribution of the study participants depending on duration of Hypertension (n=180):

Duration since Hypertension	Participants	Percentage
< 5 years	84	46.6%
5 – 10 years	55	30.6%
> 10 years	41	22.8%
Total	180	100%

Among 180 hypertensive study participants, most of the participants 84 (46.6%) whose duration of hypertension was less than five years, followed by 55(30.6%) between five to ten years and 41(22.8%) for more than 10 years.

Table 18: Distribution of the study participants according to Alcohol consumption status (n=450):

Alcohol consumption	Number	Percentage
Yes	51	11.3%
No	373	82.9%
Quitted	26	5.8%
Total	450	100%

Of the 450 study participants, majority 373 (82.9%) participants did not consume alcohol followed by 51 (11.3%) who consumed alcohol, and rest 26 (5.8%) participants had quit alcohol.

Graph 15: Distribution of the study participants according to Alcohol consumption status

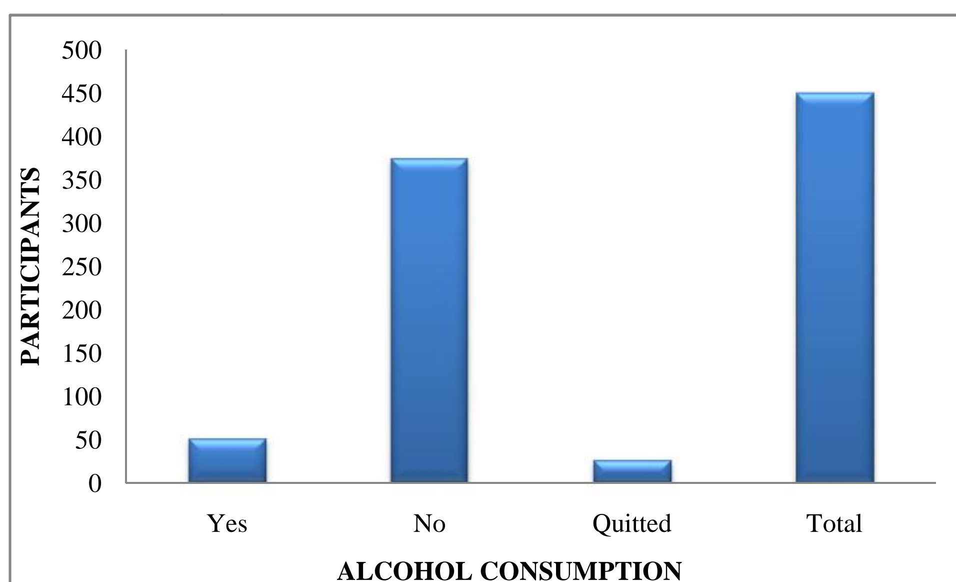


Table 19: Distribution of the study participants depending on quantity of Alcohol consumption status (n=51):

Quantity	Participants	Percentage
One Quarter	**37**	**72.6%**
Two Quarter	**10**	**19.6%**
> Two Quarter	**04**	**7.8%**
Total	**51**	**100%**

Among 51 alcoholic participants, 37(72.6%) consumed one quarter, followed by 10(19.6%) who consumed two quarters and rest 04 (7.8%) used to consume more than two quarters.

Table 20: Distribution of the study participants depending on duration of alcohol consumption (n=51):

Duration of alcohol consumption	Participants	Percentage
< 5 years	**19**	**37.2%**
5 – 10 years	**03**	**5.9%**
> 10 years	**29**	**56.9%**
Total	**51**	**100%**

Among alcoholics, 29(56.9%) had habit for more than 10 years followed by 19 (37.2%) less than five years and rest 03(5.9%) for five to ten years.

Table 21: Distribution of the study participants depending on duration of quitting alcohol consumption (n=26):

Duration of Quitting alcohol consumption	Participants	Percentage
< 5 years	00	0.0%
5 – 10 years	16	61.5%
> 10 years	10	38.5%
Total	26	100%

Of the 26 who quit alcohol, 16(61.5%) participants had quit alcohol since five to ten years and 10 (38.5%) had quit for more than ten years.

Table 22: Distribution of the study participants according to smoking status (n=450):

Smoking	Number	Percentage
Yes	36	8.0%
No	400	90.0%
Quitted	14	2.0%
Total	450	100%

Among the study participants only 36 (8.0%) were smokers and 14 (2.0%) quit smoking .

Graph 16: Distribution of the study participants according to smoking status

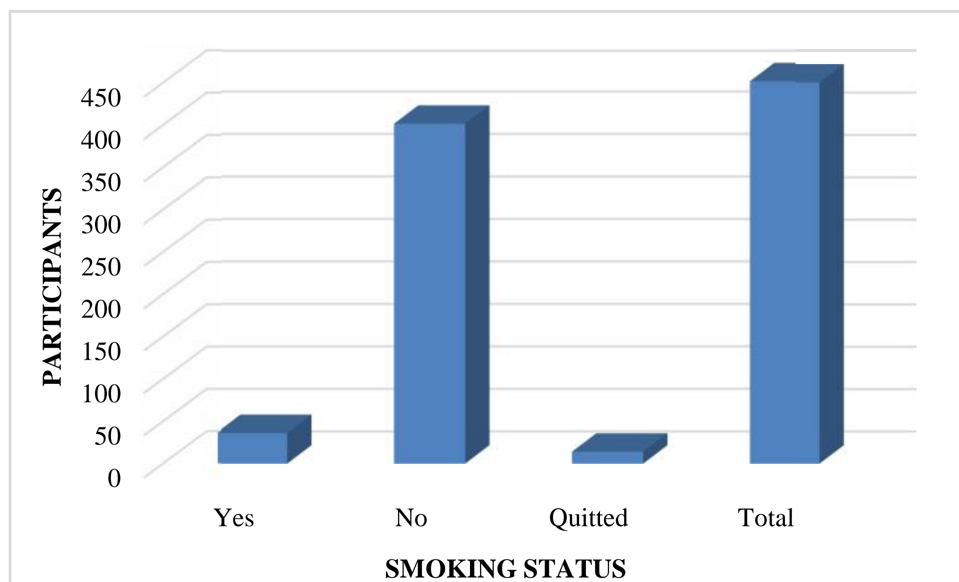


Table 23: Distribution of the study participants depending on quantity of smoking status (n=36):

Quantity of Cigarettes	Participants	Percentage
< 5	**18**	**50.0%**
5 – 10	**12**	**33.3%**
> 10	**06**	**16.7%**
Total	**36**	**100%**

Among smokers, 18 (50.0%) were smoking less than five cigarettes, 12 (33.3%) between five to ten cigarettes and 06 (16.7%) more than ten cigarettes.

Table 24: Distribution of the study participants depending on duration of smoking (n=36):

Duration of Smoking	Participants	Percentage
< 5 years	**15**	**41.7%**
5 – 10 years	**07**	**19.4%**
> 10 years	**14**	**38.9%**
Total	**36**	**100%**

Of the 36 participants who are smokers, 15(41.7%) were smoking since less than five years followed by those more than ten years 14 (38.9%) and those between five to ten years 07 (19.4%).

Table 25: Distribution of the study participants depending on duration of Quitting of Smoking (n=14):

Duration Quitting of Smoking	Participants	Percentage
< 5 years	00	0.0%
5 – 10 years	14	100%
> 10 years	00	0.0%
Total	14	100%

All the study participants who had quit smoking 14 (100%) had quit the habit between five to ten years.

Table 26: Distribution of the study participants according to Family history of fractures (n=450):

Family history	Participants	Percentage
Yes	47	10.4%
No	403	89.6%
Total	450	100%

Among 450 study participants, 403 (89.6%) had no family history of fractures and 47 (10.4%) had history of fractures.

Graph 17: Distribution of the study participants according to Family history of fractures

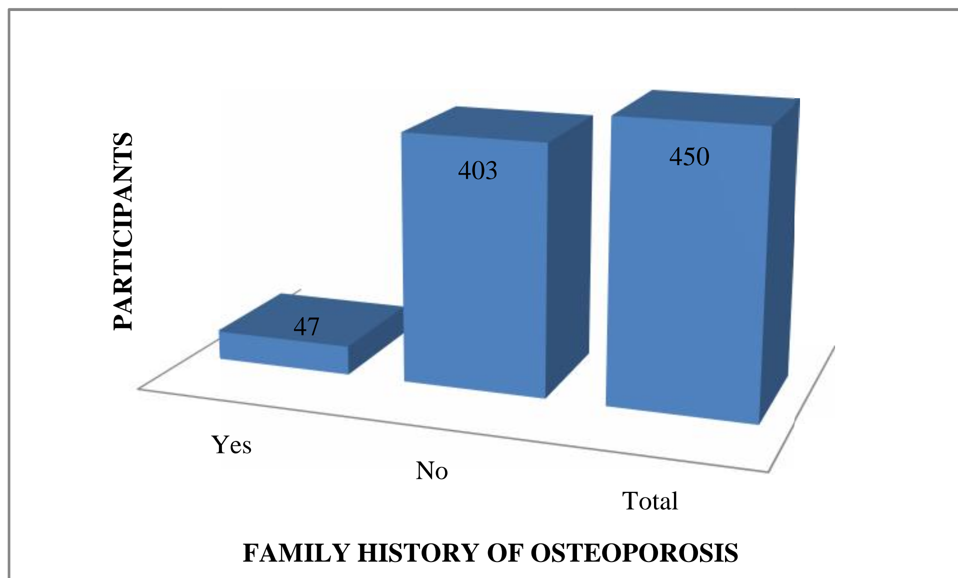


Table 27: Distribution of the study participants according to previous history of fractures (n=450):

Previous history of Fractures	Participants	Percentage
Yes	**191**	**42.4%**
No	**259**	**57.6%**
Total	**450**	**100%**

Among 450 study participants, 259 (57.6%) had no previous history of fractures and 191 (42.4%) had history of fractures.

Graph 18: Distribution of the study participants according to previous history of fractures

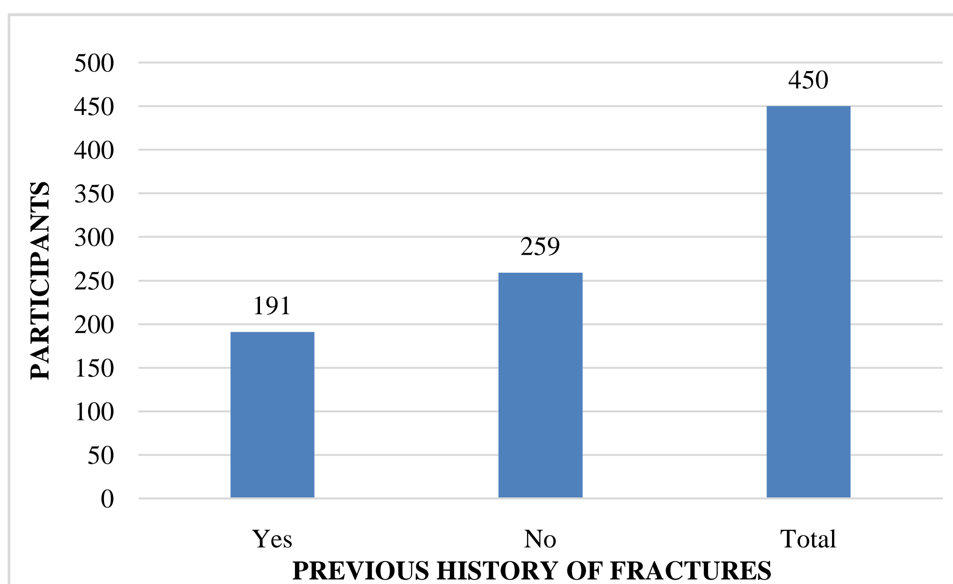


Table 28: Distribution of the study participants according to previous history of recurrent fractures (n=191):

Recurrent Fractures	Participants	Percentage
Yes	11	5.8%
No	180	94.2%
Total	191	100%

Majority of the study participants 180 (94.2%) had no previous history of recurrent fractures.

Graph 19: Distribution of the study participants according to previous history of recurrent fractures

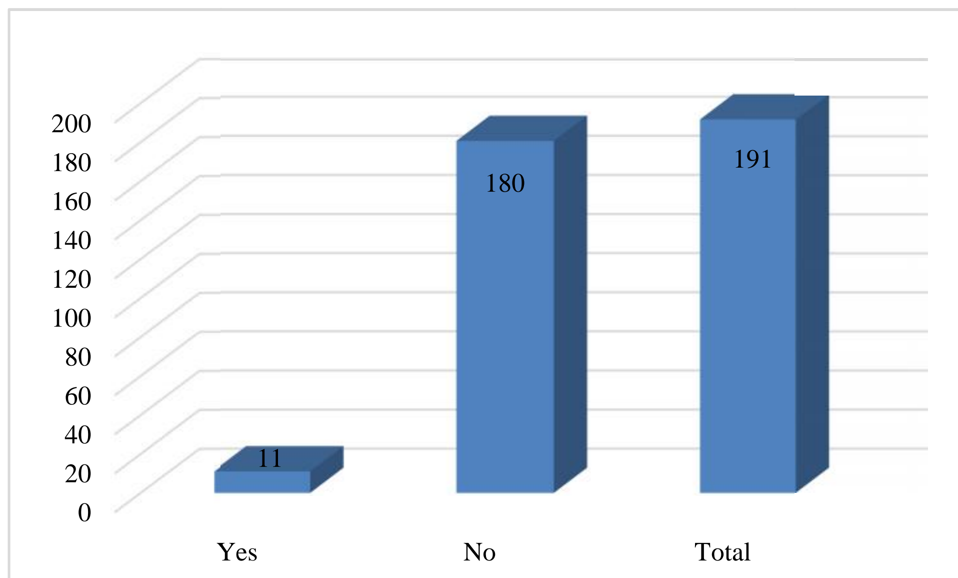
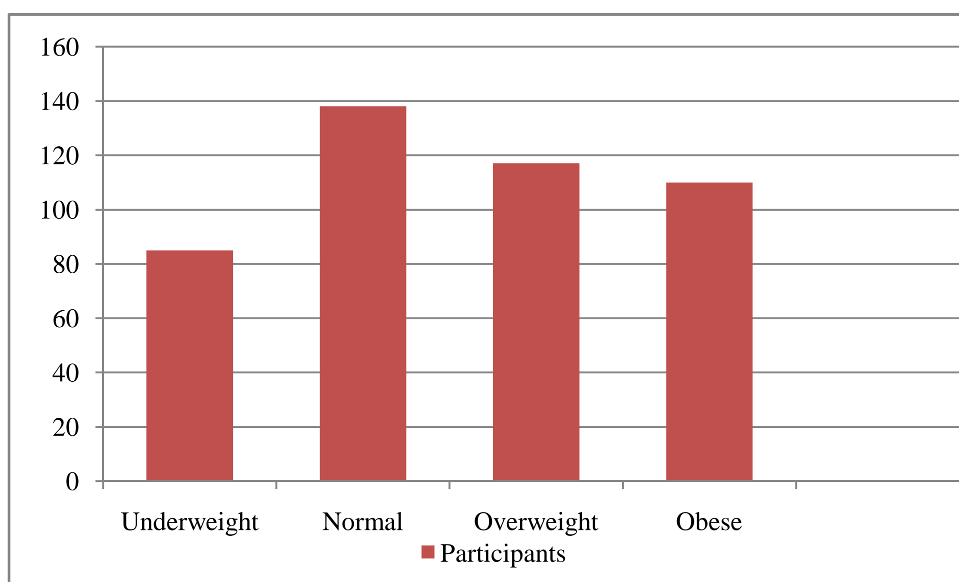


Table 29: Distribution of the study participants according to their Body Mass Index (BMI) (n=450):

BMI	Participants	Percentage
Underweight	85	18.9%
Normal	138	30.7%
Overweight	117	26.0%
Obese	110	24.4%
Total	450	100%

Most of the study participants had normal 138 (30.7%) BMI followed by overweight 117 (26.0%), obese 110 (24.4%) and rest 85 (18.9%) were underweight.

Graph 20: Distribution of the study participants according to their Body Mass Index (BMI)



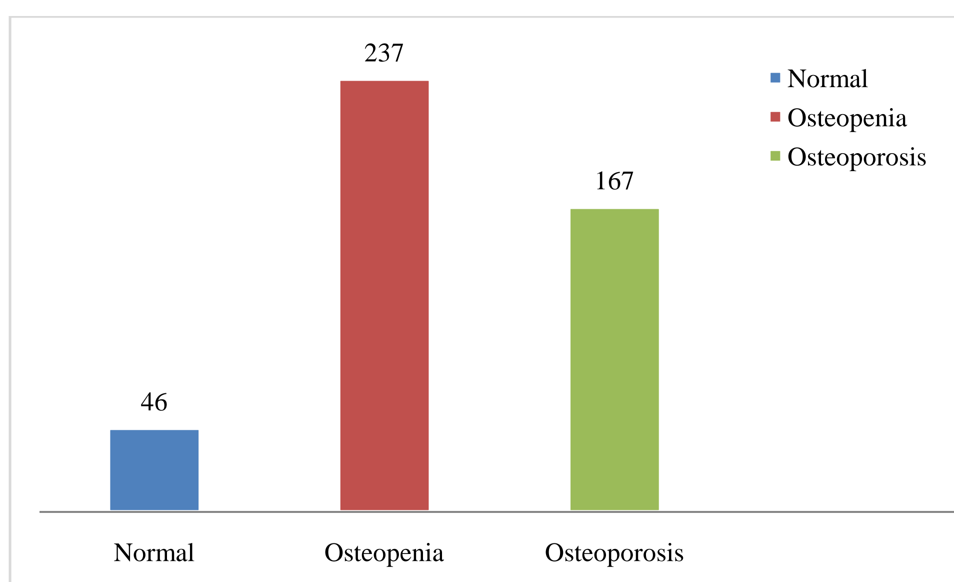
3 PREVALENCE OF OSTEOPOROSIS BY USING CALCANEAL ULTRASOUND ON STUDY PARTICIPANTS

Table 30: Distribution of the study participants according to category of Bone Mineral Density (BMD) (n=450):

Category of BMD	Participants	Percentage
Normal	46	10.2%
Osteopenia	237	52.7%
Osteoporosis	167	37.1%
Total	450	100%

In our study, majority 237 (52.7%) were diagnosed as osteopenia, followed by 167 (37.1% prevalence) who were diagnosed as osteoporosis and 46 (10.2%) were normal.

Graph 21: Distribution of the study participants according to category of Bone Mineral Density (BMD)



4 ASSOCIATION OF RISK FACTORS OF OSTEOPOROSIS ON STUDY PARTICIPANTS.

NOTE: However, for analysis we have considered only osteoporosis and not osteopenia. Osteopenia is considered as no osteoporosis.

Table No 31: Association between the Age and Osteoporosis (n=450):

Age	Osteoporosis	No Osteoporosis	Total
40-49	67(35.3%)	123(64.7%)	190
50-59	43(38.4%)	69(61.6%)	112
60-69	45(41.3%)	64(58.7%)	109
>69	12(30.8%)	27(69.2%)	39
Total	167	283	450
2: 1.842	df: 3	p – value: 0.606	

The association between age of the participants and osteoporosis, showed that the highest prevalence was seen among the age group of 60-69 years which was (41.3%) followed by 50-59 years (38.4%), 40-49 years (35.3%) and more than 69 years (30.8%). The results were not statistically significant.

Table No 32: Association between the Sex and Osteoporosis (n=450):

Sex	Osteoporosis	No Osteoporosis	Total
Male	50(34.5%)	95(65.5%)	145
Female	117(38.4%)	168(61.6%)	305
Total	167	283	450
2: 0.633	df: 1	p – value: 0.426	

In our study the association between sex of the participants and osteoporosis, the prevalence was highest among females (38.4%) than in males (34.5%). The results were not statistically significant.

Table No 33: Association between Religion and Osteoporosis (n=450):

Religion	Osteoporosis	No Osteoporosis	Total
Hindu	92(33.2%)	185(66.8%)	277
Muslim	68(44.2%)	86(55.8%)	154
Christian	07(70.0%)	03(30.0%)	10
Others	00(00%)	09(100%)	09
Total	167	283	450
2: 15.024	df: 3	p – value = 0.002	

In our study the association between religion and osteoporosis were the prevalence was highest among Christian (70.0%) followed by Muslim (44.2%) and Hindus (33.2%). The results were statistically significant.

Table No 34: Association between Education and Osteoporosis (n=450):

Education	Osteoporosis	No Osteoporosis	Total
Illiterate	**56(38.9%)**	**88(61.1%)**	**144**
Primary	**25(33.3%)**	**50(66.7%)**	**75**
Secondary	**47(45.6%)**	**56(54.4%)**	**103**
Pre-University/Diploma	**35(44.9%)**	**43(55.1%)**	**78**
Graduation	**00(00%)**	**19(100%)**	**19**
Post-Graduation	**04(12.9%)**	**27(87.1%)**	**31**
Total	**167**	**283**	**450**
2: 24.866	**df: 5**	**p – value < 0.001**	

In the present study the association between education of the participants and osteoporosis, the highest prevalence was seen among secondary school (45.6%) followed by Pre-University/Diploma (44.9%), Illiterate (38.9%), Primary school (33.3%) and less among Post-Graduation (12.9%). The results were statistically significant.

Table No 35: Association between Occupation and Osteoporosis (n=450):

Occupation	Osteoporosis	No Osteoporosis	Total
Housewife	82(40.0%)	123(60.0%)	205
Unemployed	30(73.2%)	11(26.8%)	41
Unskilled worker	14(23.3%)	46(76.7%)	60
Skilled worker	12(25.5%)	35(74.5%)	47
Business	21(48.8%)	22(51.2%)	43
Professional worker	08(14.8%)	46(85.2%)	54
Total	167	283	450
2: 45.192	df: 5	p – value < 0.001	

In the present study the association between occupation of the participants and osteoporosis, the highest prevalence was seen among Unemployed (73.2%) followed by Business (48.8%), Housewife (40.0%), Skilled workers (25.5%), Unskilled worker (23.3%) and less among Professional worker (14.8%). The results were statistically significant.

Table No 36: Association between Marital status and Osteoporosis (n=450):

Marital status	Osteoporosis	No Osteoporosis	Total
Unmarried	00(00%)	04(100%)	04
Married	139(36.5%)	242(63.5%)	381
Widowed/ widower	28(43.1%)	37(56.9%)	65
Total	167	283	450
2: 3.416	df: 2	p – value = 0.181	

In our study the association between marital status of the participants and osteoporosis, the prevalence was highest among the participants who were Widowed/ widower (43.1%) and Married (36.5%). The results were not statistically significant.

Table No 37: Association between the Socio-Economic status and Osteoporosis (n=450):

Class	Osteoporosis	No Osteoporosis	Total
I	19(35.8%)	34(64.2%)	53
II	28(30.4%)	64(69.6%)	92
III	47(41.2%)	67(58.8%)	114
IV	51(41.5%)	72(58.5%)	123
V	22(32.4%)	46(67.6%)	68
Total	167	283	450
2: 4.279	df: 4	p – value: 0.370	

In present study the association between socio-economic status of the participants and the prevalence of osteoporosis, the prevalence was highest among the participants who belong to class IV (41.5%), followed by class III (41.2%), class I (35.8%), class V (32.4%) and was comparatively less among class II (30.4%). The results were not statistically significant.

Table No 38: Association between the Diet and Osteoporosis (n=450):

Diet	Osteoporosis	No Osteoporosis	Total
Vegetarian	**47(33.8%)**	**95(66.2%)**	**139**
Mixed	**120(38.6%)**	**168(61.4%)**	**311**
Total	**167**	**283**	**450**
2: 0.937	**df: 1**		**p – value: 0.333**

The present study the association between diet of the participants and osteoporosis, the highest prevalence was seen among mixed diet (38.6%) than in vegetarian diet (33.8%). The results were not statistically significant.

Table No 39: Association between the Menopausal status in women and Osteoporosis (n=305):

Menopausal status	Osteoporosis	No Osteoporosis	Total
Yes	**96(52.9%)**	**133(47.1%)**	**229**
No	**15(27.9%)**	**44(72.1%)**	**59**
Hysterectomy	**06(15.4%)**	**11(84.6%)**	**17**
Total	**117**	**188**	**305**
2: 5.427	**df: 2**		**p – value: 0.065**

The prevalence was more among women who attained menopause (52.9%) followed by who did not (27.9%) and less among who undergone hysterectomy (15.4%) but was not statistically significant.

Table No 40: Association between duration of menopause and Osteoporosis (n=229):

Duration of menopause	Osteoporosis	No Osteoporosis	Total
< 5 years	43(41.3%)	61(58.7%)	104
5 – 10 years	15(31.9%)	32(68.1%)	47
> 10 years	28(35.9%)	50(64.1%)	78
Total	86	143	229
2: 1.366	df: 2	p – value = 0.505	

The prevalence was more among women who attained menopause (41.3%) less than five years, followed by (35.9%) who had menopause for more than 10 years and (31.9%) was between five to ten years but study was not statistically significant.

Table No 41: Association between Gravida status and Osteoporosis (n=305):

Gravida status	Osteoporosis	No Osteoporosis	Total
One	**24(42.1%)**	**33(57.9%)**	**57**
Two or more	**88(36.1%)**	**156(63.9%)**	**244**
Nil	**02(50.0%)**	**02(50.0%)**	**04**
Total	**114**	**191**	**305**
2: 0.996	**df: 2**		**p – value = 0.608**

The prevalence was more among women who had no child (50.0%) followed by women having one child (42.1%) and (36.1%) women having two or more children but was not statistically significant.

Table No 42: Association between Life style and Osteoporosis (n=450):

Life style	Osteoporosis	No Osteoporosis	Total
Active	64(33.2%)	129(66.8%)	193
Sedentary	103(40.1%)	154(59.9%)	257
Total	167	283	450
2: 2.260	df: 1	p – value = 0.133	

In our study the association between lifestyle of the participants and the prevalence of osteoporosis, the prevalence was highest among sedentary (40.1%) than active (33.2%). The results were not statistically significant.

Table No 43: Association between the Diabetes Mellitus and Osteoporosis (n=450):

Diabetes Mellitus	Osteoporosis	No Osteoporosis	Total
Yes	34(31.8%)	95(68.2%)	107
No	133(38.8%)	168(61.2%)	343
Total	167	283	450
2: 1.712	df: 1	p – value: 0.191	

In our study the association between diabetes mellitus status of the participants and the prevalence of osteoporosis, the prevalence was highest among non-diabetic participants (38.8%). The results were not statistically significant.

Table No 44: Association between the Hypertension and Osteoporosis (n=450):

Hypertension	Osteoporosis	No Osteoporosis	Total
Yes	**82(45.6%)**	**98(54.4%)**	**180**
No	**85(31.5%)**	**185(68.5%)**	**270**
Total	**167**	**283**	**450**
2: 9.166	**df: 1**	**p – value: 0.002**	

The prevalence of Osteoporosis was more among hypertensive (45.6%) than in non-hypertensive (31.5%). The results were statistically significant.

Table No 45: Association between the Alcoholic status and Osteoporosis: Since only males are Alcoholics, Osteoporosis status and Alcoholism should be analysed only in males (n=145).

Alcoholic	Osteoporosis	No Osteoporosis	Total
Yes	**27(52.9%)**	**24(47.1%)**	**51**
No	**19(27.9%)**	**49(72.1%)**	**68**
Quitted	**04(15.4%)**	**22(84.6%)**	**26**
Total	**50**	**95**	**145**
2: 13.177	**df: 2**	**p – value: 0.001**	

The prevalence of osteoporosis was highest among the alcoholics (52.9%) compared to non-alcoholic (27.9%) and those who quitted (15.4%) at the time of the study. The results were statistically significant.

Table No 46: Association between the Smoking and Osteoporosis: Since only males are Smokers, Osteoporosis status and Smoking should be analysed only in males (n=145)..

Smoking	Osteoporosis	No Osteoporosis	Total
Yes	27(75.0%)	09(25.0%)	36
No	19(20.0%)	76(80.0%)	95
Quitted	04(28.6%)	10(71.4%)	14
Total	50	95	145
2: 31.196	df: 2	p – value: <0.001	

The prevalence of osteoporosis was highest among the smokers (75.0%) compared to non-smokers (20.0%) and those who quitted (28.6%) at the time of the study. The results were statistically significant.

Table No 47: Association between Previous history of fractures and Osteoporosis (n=450):

Previous History of Fractures	Osteoporosis	No Osteoporosis	Total
Yes	100(45.6%)	91(54.4%)	191
No	67(31.5%)	192(68.5%)	259
Total	167	283	450
2: 33.046	df: 1	p – value: <0.001	

The prevalence of osteoporosis was highest among the participants who have previous history of fractures (45.6%). The results were statistically significant.

Table No 48: Association between Previous history of recurrent fractures and Osteoporosis (n=450):

Recurrent fractures	Osteoporosis	No Osteoporosis	Total
Yes	11(100%)	00	11
No	89(49.4%)	91(50.6%)	180
Total	100	91	191
2: 10.622	df: 1	p – value: 0.001	

The prevalence of osteoporosis was highest among the participants who have previous history of recurrent fractures (100%). The results were statistically significant.

Table No 49: Association between the BMI and Osteoporosis (n=450):

BMI	Osteoporosis	No Osteoporosis	Total
Underweight	**52(61.2%)**	**33(38.8%)**	**85**
Normal	**57(41.3%)**	**81(58.7%)**	**138**
Overweight	**22(18.8%)**	**95(81.2%)**	**117**
Obese	**36(32.7%)**	**74(67.3%)**	**110**
Total	**167**	**283**	**450**
2: 39.840	**df: 3**	**p – value < 0.001**	

The prevalence was highest among participants who were underweight (61.2%) followed by normal BMI (41.3%) and obese people (32.7%). The results were statistically significant.

DISCUSSION

The present study is an attempt to assess the prevalence of osteoporosis among the population aged above 40 years in selected urban areas and also to know the risk factors associated with osteoporosis. This one year cross sectional study was conducted at urban health centers Ashok Nagar, Ram Nagar and Rukmini Nagar which is the urban field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, KLE University, Belagavi, between the period of January 2015 to December 2015. The advances which have taken place with today's medical sciences in the treatment of osteoporosis it has resulted in the longer lifespan of patients with osteoporosis.

1. SOCIO-DEMOGRAPHIC PROFILE OF STUDY PARTICIPANTS

In the present study most of study participants were in the age group of 40-49 years. In a similar study carried out in Loni, Maharashtra India, maximum number of participants were in the age group of 41 – 50 years which is similar to our study.[16] Another study carried out in Kattankulathur, Tamil Nadu showed that the maximum number of participants belong to age group of 40-49 years, which was again similar to our study.[5](Table 1)

Most of the study participants were females. In a similar study carried out in Loni, Maharashtra, India, most of the participants were males than females, which was in contrast to our study.[16] Another study carried out in Kattankulathur, Tamil Nadu, maximum participants were males than females which is in contrast to our study.[5](Table 2)

Most of study participants belonged to hindu religion followed by muslims, christians and other religions (Sikhs/Jains). A similar study conducted in Jammu city, India showed majority of study participants were Hindus, followed by muslims which was similar to our study.[22] (Table 3)

Almost one-third of study participants were illiterates. Females were more uneducated than males. Among males, most of them had studied upto pre-university level. A study carried out in Loni, Maharashtra, India, majority of participants were educated as compared to our study.[16] Another study conducted in Urmia, Iran showed that most of study participants were illiterate which showed similar results as in our study.[35](Table 4)

Majority of the study participants in present study were housewives followed by unskilled workers, professional workers, skilled workers and those who had business. In a similar study carried out in Loni, Maharashtra India, most study subjects were technical workers, which is in contrast to our study.[16] Another study done in Colombia, majority of participants were home makers and one-fifth were employed.[36] (Table 5)

Majority of study participants were married in our study which was similar to a study conducted in Korean adult population.[37] (Table 6)

Most of the study participants in present study belonged to nuclear family and we could not compare this findings due to lack of similar studies. (Table 7)

Maximum number of study participants belonged to Class IV socio-economic status seen in our study. A similar study carried out in Loni, Maharashtra, India,

where most of the study participants belonged to Class I socio-economic status which is in contrast to our study.[16] (Table 8)

Majority of study participants in present study reported practicing mixed pattern of diet. Contrasting results were found in another study conducted in Loni, Maharashtra, India, where majority of study participants were vegetarian by diet.[16] Another study conducted in Jammu showed contrasting results where majority of study subjects were vegetarian.[22] (Table 9)

Among female participants majority had attained menopause in our study. A similar study carried out in Jammu, showed slightly higher number of menopausal women than our study.[22] Another study conducted in Tamil Nadu showed more number of women were in menstrual age compared to our study.[5](Table 10)

Among those who had attained menopause in our study, nearly half had attained it in past 5 years , we could not compare these finding due to lack of similar studies. (Table 11)

Most of the female study participants in our study were multigravida. In a similar study carried out in military hospital Dehradun majority of females were those who were multigravida which is similar to our study.[18] (Table 12)

Among the study participants more than half of the participants had a sedentary lifestyle where as in a study carried in Jammu, one third of study participants had sedentary lifestyle, which was low in compared to our study.[22] (Table 13)

Nearly one third of the study participants were Diabetes in our study. A similar study carried out in Sydney, Australia only 6% of the study participants had

self reported to have diabetes which was comparatively very less than our finding.[38] (Table 14)

Among those who had diabetes, more than half were diagnosed in the past 5 years. A study carried out in Sydney, Australia 2.6% diabetic participants were self reported to have diabetes since past 4 years, the results of which was similar to our study.[38] (Table 15)

Hypertension was reported by more than one third of the study participants in our study. A similar study carried out in Colombia, very few study participants had hypertension, which is comparatively less than our study.[36] (Table 16)

Among the Hypertensive subjects, nearly half among them were diagnoised in the past 5 years. We could not compare these findings due to lack of similar studies. (Table 17)

Deleterious habit like alcohol consumption was reported among few (51) male participants and few (26) male participants had history of alcohol consumption. A similar study carried out in Colombia few (7%) study participants reported to practice alcohol consumption results were similar to our study.[36] (Table 18)

Among the alcoholics majority of the participants consumed one quarter per day in our study. We could not compare these findings due to lack of similar studies. (Table 19)

Among the alcoholic participants more than half had the habit for more than 10 years in our study. We could not compare these findings due to lack of similar studies. (Table 20)

Few of the study participants had previous history of alcohol consumption with most of them quit alcohol 5-10 years back. We could not compare these findings due to lack of similar studies. (Table 21)

In our study few (36) participants were smokers and few (14) were those who quit smoking. In a similar study conducted in Colombia results were similar when compared to our study.[36] (Table 22)

Most of the study participants who were smokers were smoking less than 5 cigarettes per day. In a study conducted in Colombia few of participants were smokers with history of smoking 10 cigarettes per day, results were high when compared to our study.[36] (Table 23)

Among the smokers less than half were smoking since less than 5 years. We could not compare these findings due to lack of similar studies. (Table 24)

Among the study participants who had quit smoking, all had quit the habit between 5 -10 years. We could not compare these findings due to lack of similar studies. (Table 25)

Among study participants few had family history of fractures in present study. In a similar study carried out in Loni, Maharashtra, India, where results were similar to our study.[16] Another study conducted in Urmia, Iran, only few (13) participants has family history of fractures which is similar to our study. [35] (Table 26)

Most of the study participants had previous history of fractures in present study. A similar study conducted in Urmia, Iran only few participants had previous history of fractures which is in contrast to our study.[35] Another study conducted in

Colombia one fourth of participants has history of fractures which is less compared to our study.[36] (Table 27)

Among the study participants who had previous history of fractures, very few had history of recurrent fractures. A similar study conducted in Taiwan, very few participants had history of recurrent fractures, which was similar to our study.[39] (Table 28)

Most of participants in our study had normal BMI followed by overweight and obese. A similar study carried out in Colombia, most of the participants had BMI in normal category which was similar to our study.[36] (Table 29)

The prevalence of osteoporosis in our study was found to be 37.1%. More than half of the study participants had osteopenia (52.7%). In a similar study conducted in Loni , Maharashtra India, 28% of study participants had osteoporosis, 31.6% had osteopenia and 40.91% were found to be normal. Which was relatively less than our study.[16] Another study done in semi urban region in southern India showed prevalence of osteoporosis to be 48%. This was high comparable with the prevalence rate of osteoporosis in our study.[23] Another study conducted in Chitwan district, Nepal, 26.2% of study participants had osteoporosis, 39.3% had osteopenia and 34.4% were found to be normal.[19] (Table 30)

Association between risk factors and prevalence of osteoporosis.

In the present study highest prevalence was seen among the age group of 60-69 years. Similar study done among Jordanian women showed that there was significant association between age of women and prevalence of osteoporosis and it was highest among women more than 60 years.[40] Another study done in Korean adult

population also showed significant association between increasing age and prevalence of osteoporosis.[37] (Table 31)

In our study there was no significant association between sex of participants and prevalence of osteoporosis but similar study done in Taiwan showed that there was significant association between female sex and the prevalence of osteoporosis.[41] (Table 32)

There was significant association between religion of participants and prevalence of osteoporosis in our study. Prevalence of osteoporosis was highest among Christians followed by Muslims and Hindus. Similar study done in Jammu showed significant association between religion and prevalence of osteoporosis, highest prevalence was seen among Hindus.[22] (Table 33)

Significant association was seen in our study between education of the participants and prevalence of osteoporosis. The highest prevalence was seen among participants who attended secondary schooling followed by those who attended Pre-University. A similar study done among Chinese post-menopausal women showed similar results and the prevalence of osteoporosis was highest among illiterate women.[42] (Table 34)

Unemployed participants had the higher prevalence of osteoporosis followed by those who were businessmen and housewives. A similar study done in Colombia showed prevalence was more among homemakers and results were not significant.[36] (Table 35)

Marital status had no bearing on the osteoporosis among the participants in our study. Similar studies done among elderly women in Korean and USA showed

significant association between marital status of the participants. The prevalence of osteoporosis was highest among widowed and divorced participants, which was in contrast to findings in our study.[37, 43] (Table 36)

Standard of living was not a significant contributor for the occurrence of osteoporosis in our study. A similar study conducted on Korean adult population showed significant association between household income and prevalence of osteoporosis. The result was contrast to our study.[37] (Table 37)

There was no significant association between diet of the participants and prevalence osteoporosis, the highest prevalence was seen among non-vegetarians. A similar carried out in Dehradun also showed similar results.[18] (Table 38)

The prevalence of osteoporosis was high among women who had attained menopause compared to those who were in reproductive phase and who had hysterectomy. Similar study done in Bhuj, Gujarat showed similar results.[44] Another study conducted on Jordanian women also showed similar results but in our study it was not significant.[40] (Table 39)

Among those who had attained menopause, osteoporosis was high in those who had attained it in last 5 years, we could not compare there findings due to lack of similar studies. (Table 40)

Childless women had more chances of suffering from osteoporosis than those who had children. Similar studies conducted in Dehradun and Bhuj, Gujarat showed highest prevalence of osteoporosis in multigravida.[18, 44](Table 41)

Though not significant, sedentary participants had higher chance of suffering from osteoporosis than physically active. Similar study conducted in Jammu showed highest prevalence in active participants but study was not significant.[22] (Table 42)

Diabetes mellitus was not contributor in the causation of osteoporosis in our study. In a study conducted among Jordanian women there was a significant association between diabetes mellitus status of the participants and prevalence of osteoporosis, the prevalence was highest among diabetic participants.[40] (Table43)

Hypertensives were more likely to suffer from osteoporosis than normotensives. The results were similar to Jordan study.[40] (Table 44)

Participants who consumed alcohol had higher chances of suffering from osteoporosis than who did not consume alcohol. A similar study conducted among Korean adult population showed significant association of consumption of alcohol with prevalence of osteoporosis.[37] (Table 45)

Deleterious habits like smoking contributed to the causation of osteoporosis in our study. A similar study conducted among Korean adult population showed significant association of smoking with prevalence of osteoporosis where results were similar to our study.[37] Another study conducted on Jordanian women population showed no significant association of smoking and osteoporosis which is in contrast to our study.[40] (Table 46)

People who had suffered from fractures previously had more likely chances of getting osteoporosis A similar study conducted in Taiwan showed significant association between previous history of fractures with prevalence of osteoporosis, which is similar to our study.[39] (Table 47)

Among those with previous history of fractures, those with previous history of recurrent fractures had higher risk of suffering from osteoporosis, we could not compare there findings due to lack of similar studies. (Table 48)

Study participants with low BMI had higher chances of suffering from osteoporosis than those with normal and high BMI. A Korean adult population study showed similar results as our study.[37] Another study showed contrast results conducted on Jordanian women population showed that BMI was not associated with the occurrence of osteoporosis.[40] Another study done in Korean population also showed similar results as our study.[45] (Table 49)

CONCLUSION

In this cross sectional study 450 participants above 40 years of age were evaluated with Calcaneal QUS (Quantitative Ultra Sonography) for the presence of osteoporosis and various risk factors were assessed.

The overall prevalence of osteoporosis in this study was 37.1%, osteopenia was 52.7% & adults with normal BMD values were 10.2%. Factors such as religion and beliefs, education, occupation, comorbidity like hypertension, habits like alcohol consumption and smoking in male participants, history of previous and recurrent fractures and BMI of the study participants played a significant role in the prevalence of osteoporosis. As the disease represents tip of the iceberg it is important to create awareness, educate the community especially the adults who are at risk so that these high risk individuals can report early to the health care setup.

LIMITATIONS

The limitations of the study are:

- The study would have been more generalised if all population aged above 40 years would have been included.
- A follow up of study participants would have given us more information regarding the symptoms and progression of the disease.
- Information regarding associated morbidities in some of the study participants was self-reported which could have led to recall bias.
- It was not possible to investigate all the study participants for serum calcium levels and Dual Energy X-ray Absorptiometry (DEXA) due to financial liabilities and immobility of the DEXA machine.

RECOMMENDATIONS

On the basis of this study, following recommendations are being suggested to improve the health of the individuals at risk:

- Universal screening for osteoporosis is recommended.
- Education by a trained orthopedician / community based health educator is suggested in all individuals more than 40 years of age or having any risk factors.
- Life style modification w.r.t diet, exercise and other comorbidities should be started at an early age and continued.
- Early supplementation of calcium in the high risk individuals is recommended.
- Regular checkup of blood glucose, blood pressure, consultation with doctor and adherence to the line of treatment prescribed should be strictly followed.

SUMMARY

The present study was a community based cross sectional study undertaken to assess the prevalence of osteoporosis among population aged above 40 years in selected urban areas of Belagavi, and also to know the risk factors among 450 study participants.

This study was carried out in Urban Health Centers of Ashok Nagar, Ramnagar and Rukmini nagar which is urban field practice area of Department of Community Medicine, KLE University, J. N. Medical College, Belagavi. A total of 450 paticipants were included for the study and the duration of study was one year from 1st January 2015 to 31st December 2015. A pre-designed and pre-tested questionnaire was used to collect the data from the participants. Bone Mineral Density was assessed by using Calcaneal QUS (Quantitative Ultra Sonography).

In the current study, majority i.e. 42.2% participants belonged to 40 – 49 years of age group and mean age was 53.9 ± 10.12, 68.8% were females and 61.6% were Hindu by religion.

A large number of study participants 32.0% were illiterate. As many 67.2% of the female participants were housewives and 30.3% of the male participants were skilled worker.

Majority 84.7% participants were married and 70.9% of the participants were living in a nuclear family. Most of the participants belonged to class IV (27.3%) socio-economic status as per modified B G Prasad classification. Most of the participants 69.1% practiced mixed diet.

Among the female participants 75.1% had attained menopause, among them 45.5% reported to have attended menopause in last 5 years and 80% of female participants were multi gravida.

Sedentary lifestyle was reported that 55.2% of male participants and 58%of female participants.

Participants who had history of diabetes were 23.8% and among them 50.5% had duration of diabetes for less than 5 years.

Participants who had history of hypertension were 40% and among them 46.6% had duration of hypertension for less than 5 years.

Participants who consumed alcohol were 17.1%, among them 56.9% are consuming alcohol from the past 10 years.

Study participants who practiced smoking were 10% and 50% among them were smoking from the past 5 years.

Study participants ho had family history of fractures were only 10.4% and 48.4% of the study participants had history of previous fractures.

Normal BMI was recorded in 30.7% of the study participants.

Prevalence of osteoporosis was found to be 37.1%, Osteopenia 52.7% and normal 10.2% among study participants.

All religion, education, occupation, hypertension, alcohol consumption, smoking, previous history of fractures, previous history of recurrent fractures and

body mass index were found to be significantly association with prevalence of osteoporosis with p-value < 0.05.

The increased trend of Osteoporosis in India has become a major public health problem. Timely action should be taken to screen all the individuals who are at risk for developing the disease with bone mineral density test. The following measures like, a healthy diet, regular physical activity and regular follow up at orthopedic clinics, would definitely help the patients of osteoporosis to cope up better with the disease. Good health education will help these patients to identify the complications associated with osteoporosis at an early stage and help them to lead a better life.

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ANNEXURE – I – ETHICAL CLEARANCE LETTER

K.L.E.UNIVERSITY'S
JAWAHARLAL NEHRU MEDICAL COLLEGE,
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Ref: MDC/DOME/ **Date: 13/11/2014**

To,

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"PREVALENCE OF OSTEOPOROSIS AMONG POPULATION AGED ABOVE 40 YEARS IN SELECTED URBAN AREAS OF BELGAUM – A CROSS SECTIONAL STUDY"**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr.Hema Dhumale)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr.Ganga Pilli)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

ANNEXURE-II CONSENT FORM

INFORMED CONSENT

“PREVALENCE OF OSTEOPOROSIS AMONG POPULATION AGED ABOVE 40 YEARS IN SELECTED URBAN AREAS OF BELAGAVI - A CROSS SECTIONAL STUDY.”

INVESTIGATORS: _____________

____

Introduction

Osteoporosis is a growing health problem recognized in both developed and developing countries associated with substantial morbidity and socio-economic burden worldwide. Osteoporosis is a disease characterized by reduction in the bone mass and disruption of bone architecture leading to impaired skeletal strength and an increased susceptibility of fractures. Osteoporosis is recognized as a world-wide health problem and in India it has become more common for medical practitioners to see people suffering from osteoporotic fractures. Osteoporosis can be prevented and treated if diagnosed early and accurately. Unfortunately, it is often undiagnosed until a fracture occurs. Therefore, the study is undertaken to find out the prevalence of osteoporosis among population aged above 40 years and you are invited to participate in the study. Participation in the study is completely voluntary.

Explanation of procedures

In this study your detailed clinical examination will be done and also scan of foot will be taken for you to estimate your Bone Mineral Density. You will have to answer a few questions about your social-demographic details, diet patterns, general health information etc. The entire procedure may take 1/2 an hour.

Possible benefits

The investigator does not promise or guarantee that you will receive direct benefit being in the study. It will benefit the whole community because by this study we will know the risk factors associated with breast cancer, and accordingly the preventive and control measures can be taught.

Possible risks

There are no risks involved for participation in the study.

Confidentiality

Your identity will not be revealed. All information collected will be collected and coded so that no one will know your identity.

Withdrawal

Participation in this study is voluntary. If you do not wish to participate in this study, you will not lose benefits to which you are entitled.

Costs of participation

The cost of the study will be borne by the researcher. There will be no additional cost to you for participating in this study.

Payment of participation

There will be no incentives to you for participating in this study.

Authorization to publish results

The Researchers may use the information gathered from this study for presentation in scientific journals. However your identity will not be disclosed in such presentation or publication.

Legal Rights

By signing this consent form, you are not waiving any of your legal rights.

Questions

If you have any questions about this study, you may contact

If you have any questions about your rights as a study participant, you may contact **DR. GANGA S. PILLI,** Chairman, JNMC Institutional Ethics Committee on human subjects research at 0831- 2741701

Consent statement

I volunteer and consent to participate in this study. I have read the consent or explained to me in my local languages. The study has been fully explained to me and I had been given the opportunity to ask questions and they have been answered to my satisfaction and that I have received a copy of this signed consent form.

Name of the participant: ____________________ Signature/ left thumb impression

Name of the eyewitness: ___________________ Signature/ left thumb impression

Name of the interviewer: _____________________ Signature

Date: | | | |

ANNEXURE III- QUESTIONNAIRE

PREVALENCE OF OSTEOPOROSIS AMONG POPULATION AGED ABOVE 40 YEARS IN SELECTED URBAN AREAS OF BELAGAVI- A CROSS SECTIONAL STUDY.

SOCIO DEMOGRAPHIC DATA

Name :

____

Age : ______ years

Sex : ______

1. Religion:

a) Hindu

b) Muslim

c) Christian

d) Others (specify).

2. Education:

a) Illiterate

b) Primary school

c) High school

d) Pre-university/Diploma

e) Graduate

f) Post Graduate

3. Occupation: a) Housewife

b) Unemployed

c) Unskilled workers

d) Skilled workers

e) Clerical/Shop owner/Farmer

f) Professional workers

4. Marital status: a) Unmarried

b) Married

c) Widowed

d) Divorced / Separated

5. Type of Family: a) Joint

b) Nuclear

c) Broken family

6. Socio Economic Status: a) Monthly income of the family:

b) Total number of family members:

c) Monthly per capita income:

d) B.G Prasad class :

7. What kind of diet you are taking? a) Vegetarian, b) Mixed

8. Attained menopause? a) Yes, b) No

If attained since _______ Years

9. Gravida status? a) 01, b) 02 or more

10. Life style. a) Active, b) Sedentary

11. Are you known case of Diabetes Mellitus? a) Yes, b) No

If yes since when_______ Years

12. Are you a known case of Hypertension? a) Yes, b) No

If yes since when_______ Years

13. Do you drink Alcohol? a) Yes, b) No/Quitted

If yes, quantity _______

If yes, since when_______ Years

If Quitted, since when _______

14. Do you smoke Cigarettes/ Beedi? a) Yes, b) No

If yes, number _______

If yes, since when_______ Years

If Quitted, since when _______

15. Any family history? a) Yes, b) No

If yes, _______

16. Previous history of fractures? a) Yes, b) No

17. Recurrent fractures? a) Yes, b) No

CLINICAL EXAMINATION

General Physical Examination

1) Built and nourishment: Poor / Moderate / Fair
2) Height: ________ cms
3) Weight: _______ Kgs.
4) BMI:-

Systemic Examination

1) **CVS:**
2) **R/S:**
3) **P/A:**
4) **CNS:**

INVESTIGATION

Bone Mineral Density: ____________________

ANNEXURE IV- KEY TO MASTER CHART

PREVALENCE OF OSTEOPOROSIS AMONG POPULATION AGED ABOVE 40 YEARS IN SELECTED URBAN AREAS OF BELAGAVI- A CROSS SECTIONAL STUDY.

A) Age (40-81)

B) Sex

1- Male

2- Female

C) Religion

1- Hindu

2- Muslim

3- Christian

4- Others

D) Education

1- Illiterate

2- Primary school

3- High-school

4- Pre University / Diploma

5- Graduate

6- Postgraduate

E) Occupation

1- House wife

2- Unemployed

3- Unskilled worker

4- Skilled worker

5- Buisness

6- professional worker

F) Marital status

1) Unmarried

2) Married

3) Widow / Widowed

G) Type of family

1) Joint

2) Nuclear

3) Broken

H) Socio-Economic status (according to modified B.G. Prasad classification)

1) Class-I

2) Class- II

3) Class- III

4) Class- IV

5) Class- V

I) Diet

1) Vegetarian

2) Mixed

J) Menstrual history

1) Attained Menopause

2) Not attained Menopause

3) Hysterectomy done / Male

K) If attained menopause, since when

1- <5 years

2- 5-10 years

3- >10 years

4- Not applicable

L) Gravida status

1- one

2- 2 or more

3- Nil

4- Not applicable

M) Lifestyle

1- Active

2- Sedentary

N) Diabetes Mellitus

1) Yes

2) No

O) If Diabetic, since when

1- <5 years

2- 5-10 years

3- >10 years

4- Not applicable

P) Hypertension

1- Yes

2- No

Q) If Hypertensive, since when

1- <5 years

2- 5-10 years

3- >10 years

4- Not applicable

R) Alcohol Consumption

1- Yes

2- No

3- Quitted

S) Quantity of alcohol consumption

1- 1 quater

2- 2 quaters

3- > 2 quaters

4- Not applicable

T) Duration of alcohol consumption

1- <5 years

2- 5-10 years

3- >10 years

4- Not applicable

U) If quitted alcohol, since when

1- <5 years

2- 5-10 years

3- >10 years

4- Not applicable

V) Smoking

1- Yes

2- No

3- Quitted

W) **If Smoking, number of cigarettes**

1- <5

2- 5-10

3- >10

4- Not applicable

X) If Smoking, since when

1- <5 years

2- 5-10 years

3- >10 years

4- Not applicable

Y) If quitted smoking, since when

1- <5 years

2- 5-10 years

3- >10 years

4- Not applicable

Z) Family history of fractures

1- Yes

2- No

AA) Previous history of fractures

1- Yes

2- No

AB) Recurrent history of fractures

1- Yes

2- No

AC) Built

1- Poor

2- Moderate

3- Fair

AD) BMI

1- <18.5 kg/m^2

2- 18.5- 22.9 kg/m^2

3- 23 kg/m^2

4- >25 kg/m^2

AE) BMD Category

1- Normal

2- Osteopenia

3- Osteoporosis

MASTER CHART

85	SEX	RELIGION	EDUCATION	OCCUPATION	mar sts	TYPE OF FAMILY	SOCIO ECONOMIC STATUS	DIET	MENOPAUSE	IF ATTAINED?	GRAVIDA STATUS	LIFE STYLE	DM	DURATION	HTN	DURATION	ALCOHOL CUMSUPTION	QUANTITY	SINCE WHEN	QUITTED SINCE WHEN	SMOKING	NUMBER	SINCE WHEN	QUITTED	FAMILY HISTORY	PREVIOUS HISTORY	RECURRENT	BUILT	BMI	BMD CAT
44	1	1	4	4	2	2	4	1	3	4	4	1	2	4	2	4	1	1	3	4	2	4	4	4	2	1	2	2	4	2
70	1	1	3	4	2	2	2	1	3	4	4	2	1	2	1	2	3	4	4	3	3	4	4	2	2	1	2	3	4	2
49	1	1	6	6	2	2	1	2	3	4	4	2	2	4	2	4	2	4	4	4	2	4	4	4	2	1	2	3	4	2
40	2	1	3	1	2	2	4	1	2	4	2	2	2	4	2	4	2	4	4	4	2	4	4	4	2	2	2	2	2	2
65	1	1	3	4	2	2	2	1	3	4	4	2	2	4	2	4	1	1	3	4	2	4	4	4	2	2	2	3	4	2
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55	2	1	3	1	2	1	1	1	1	1	2	2	1	1	2	4	2	4	4	4	2	4	4	4	2	1	2	2	3	3
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42	2	1	1	3	2	2	2	1	1	2	2	2	2	4	2	4	2	4	4	4	2	4	4	4	2	2	2	2	3	3
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43	1	2	1	3	2	1	4	2	3	4	4	2	2	4	2	4	2	4	4	4	2	4	4	4	2	2	2	2	4	1
40	2	2	1	1	2	1	4	2	2	4	2	1	2	4	2	4	2	4	4	4	2	4	4	4	2	2	2	1	1	1
64	1	1	4	4	2	1	4	2	3	4	4	2	2	4	1	2	3	4	4	2	2	4	4	4	2	2	2	2	2	2
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58	1	1	3	3	2	2	4	2	3	4	4	1	2	4	1	1	2	4	4	4	2	4	4	4	2	2	2	2	4	1
45	2	2	1	1	2	1	5	2	1	1	2	2	2	4	2	4	2	4	4	4	2	4	4	4	2	2	2	2	3	2
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