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Awareness about Osteoporosis, dietary calcium, and extent of noncompliance to medications among educated postmenopausal women of Kerala.

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Abstract

Purpose: To assess knowledge regarding osteoporosis, dietary calcium and sources, dairy intake and misconceptions among educated postmenopausal, affluent women.

Methods: This cross-sectional study assessed awareness of educated postmenopausal women using validated Osteoporosis Knowledge Assessment Tool (OKAT). Details regarding dietary calcium intake was done by face-to-face interview. Relevant biochemistry and BMD were performed.

Results: Among 478 postmenopausal women, 111 fulfilled the inclusion criteria. Mean±SD age and BMI of the patients were 60.97±8.28 years and 26.58±4.48 kg/m^2.

Twenty six (23.4%) of our patients were professionals and 50(45%) had college education. Average years post-menopause was 13.63±8.57 years. Out of 111 studied, 45(40.54%) were not aware that bone health decreases after menopause. Half our patients 58(52.7%) did not receive medical advice regarding calcium intake ever. 45(40.5%) were never on calcium supplements postmenopause. Though 60(54.05%) of our patients were taking calcium, only 29(26.12%) were taking it

daily at optimal dose. Mean daily dietary calcium intake was 474.55± 222.73 mg.

Conclusions: This study showed a deficit in awareness of osteoporosis, dietary calcium intake & calcium supplements, even among educated, rich women. Improving awareness may help prevent osteoporosis related complications.

Keywords: Osteoporosis, calcium intake, dietary calcium, bone health, postmenopausal women, BMD.

Introduction

It is well known that maximal bone accrual and peak bone mass is attained during adolescence and reaches a steady state during the adult years [1]. Thereafter there is a steady decline of bone mineral content and density, leading on to osteopenia, osteoporosis and fractures [2]. This is especially true in women, since the hormonal changes during menopause add to the decline in bone health. India being the second largest country in terms of population and having a life expectancy of 69 years has an estimated 43 million postmenopausal women [3].

There are several factors that influence the decline of bone mineral density. Important among the modifiable risk factors are physical activity and nutrition. Dietary intake of protein, calcium and vitamin D [4-8] play a significant role in one's bone health. Diet of an average Indian in the postmenopausal age is grossly deficient in calcium as well as dairy products [9]. Moreover, as high as 85% of the Indian population could be vitamin D deficient [10]. Supplementing or fortifying diet with calcium and vitamin D is necessary in such a setting. However, there aren't any government driven programs for this. In fact, the healthcare system in India, like many others, does not cater actively to prevent fragility fractures, although studies from different parts of India have shown high prevalence of osteoporosis and fragility fractures [11], in the elderly, especially postmenopausal women. Nutritional advice and routine calcium supplementation through primary health centres across the country, for the postmenopausal population is a way forward. However as India continues to be a patriarchal society, the general care as well as medical care received by elderly women is less than optimal to achieve this.

The alternate solution would be to make the general public more aware of the problem of osteoporosis and the preventive measures they can easily adapt. Taking sufficient dairy products which are a good source of calcium and protein, would be one such simple measure. A large body of evidence clearly states the protective effect of dairy products on osteoporotic fracture risk [4, 7, 8, 12-14]. However, several misconceptions regarding intake of dairy products and calcium exist and are often propagated via social media. This may be because of studies that have shown no benefit in taking dairy products [15, 16]. Such negative propaganda further adds to the burden of ignorance regarding osteoporosis, calcium supplements and dairy intake.

Kerala with near 100% literacy, ought to be above such myths and misconceptions. We expected that well educated people of Kerala, with high socioeconomic background to be well aware of postmenopausal osteoporosis and hence to be on a calcium rich diet. Hence this study, where we sought to gather evidence whether our assumption is true or whether lack of awareness exists even among the educated women as well as the source of such misconceptions, if any.

Methods

This study was conducted among outpatients who attended the department of Endocrinology and Metabolism, of a tertiary care Centre in central Kerala,

during a six month period from August 2019 to February 2020. This was a cross sectional study.

Inclusion Criteria

Women above the age 50 years, postmenopausal for at least 5 years or above, and physically active in their day to day life were included. Only those women with educational level above higher secondary were included. All patients were interviewed in detail regarding their socio economic status (SES) and only those who belonged to the high SES according to modified B.G Prasad Socio-economic Classification [17] were included for further study.

Exclusion Criteria

All women with end stage organ disease, endocrine disorders like thyrotoxicosis, Cushing's syndrome, past history of malignancy, or ongoing treatment with steroids or other medications which could alter bone density, and those people who were not physically active were excluded from the study. Wheel chair or bed bound patients were not included.

Physical assessment

All patients had their height and weight measured using standard protocol and BMI (Body Mass Index) was calculated. Vital parameters like blood pressure and heart rate were also measured routinely.

Assessment of educational status:

The educational status of the participants was assessed, and it was classified as follows:

a) Higher Secondary school
b) College Level
c) Professional

Nutritional History

All patients were interviewed face to face regarding dietary calcium using a detailed diet history and one week diet recall. Subjects were asked to specify the quantity of milk taken by them (in various manner- as milk, tea, coffee, curds, paneer etc). They were asked about the quantity of milk bought at home and number of family members. Quantity of milk taken by the subject was compared against this and reassessed to make sure the information was correct.

Each subject was also interviewed regarding various commonly used and locally available sources of calcium, like fish, ragi, egg whites, nuts, leafy vegetables etc. They were asked to specify the quantity and frequency of consuming these in the past one week. This was used to calculate the calcium obtained from each kind of food using the average calcium content of that food item, using standard calculated values. Thus daily calcium intake from each food item was calculated, with mean and SD.

Questions regarding menopause, calcium and bone health

History and time of menopause was elicited. Patients who had undergone hysterectomy were asked if the ovaries were retained. Patients were also asked about their awareness of bone health, osteoporosis, whether they had received medical advice regarding calcium intake, dose and regularity of calcium if they were on it, and the reasons for not being on adequate calcium, if they were not on supplements.

They were asked to elaborate on their concerns, misconceptions or fears about calcium supplements or milk intake and were also asked to give the source of such concerns.

Other comorbid conditions and concurrent medications were all entered in detail into a proforma. Marital status, employment, history of substance abuse, duration and regularity of daily physical activities in addition to chores, etc were also noted.

OKAT questionnaire

Knowledge regarding osteoporosis was assessed using the OKAT questionnaire. OKAT is a valid and reliable tool to assess knowledge about osteoporosis [18] and consists of 20 questions. The first 12 questions pertain to knowledge; questions 13–17 were to assess their understanding of risk factors of osteoporosis and the last three questions assessed practice and perception of osteoporosis prevention. It consists of multiple choice questions with each question having three options such as “true,” “false,” and “I don’t know.” The response “I don’t know” and unanswered questions were regarded as incorrect.

Relevant biochemical investigations like albumin corrected calcium, phosphorous, vitamin D, alkaline phosphatase, and parathyroid hormone were ordered and data entered into the proforma. Bone mineral density test (hip and lumbar spine) was done for those patients who consented and who could afford the same.

Data Analysis

The proforma was made on Google forms and data was entered into it. All continuous variables were expressed as mean $\pm$ standard deviation (SD). Categorical variables were expressed as percentages.

Results

During the study period a total of 478 postmenopausal women visited our outpatient department. Among them 111 fulfilled the inclusion criteria of high SES, education above higher secondary school and being physically active. The mean ± SD age of the patients was 60.97± 8.28 years. Average BMI was 26.58 ± 4.48 kg/m^2. Most of our patients were married - 104 (94.5%). 26(23.4%) of our patients were professionals and 50 (45%) had completed college education. (Fig.1)

Average number of years after menopause was 13.63 ±8.57 years. Forty five (40.5%) had attained natural menopause or had hysterectomy with retained ovaries, while 66(59.45%) had pan hysterectomy not sparing the ovaries.

Comorbidities

Some of our patients had other illnesses for which they were on medications-

Hypertension 24(21.62%), diabetes 12(10.8%) and 35(31.5%) had hypothyroidism.

Knowledge and Awareness

Among 111 patients, 45(40.54%) were not aware that bone health decreases after menopause. More than half of our patients 58 (52.7%) did not receive any medical advice regarding calcium intake ever. Almost half of Patients (46.8%) had received advice regarding calcium intake and 45 (40.5%) were never on calcium supplements after menopause. Though 60 (54.05%) of our patients were taking calcium, many were on a suboptimal dose (< 500mg %) or were not regular in taking it. At least 500 mg% or more calcium supplements were taken by 54(48.6%) of our patients, but not many were regular with it. Only 29(26.12%) were taking it daily at an optimal strength. (Fig.2)

Patients had several reasons for not being on or regular with calcium supplements (table 1)

Sources of dietary calcium (Fig. 2)

Most of our patients belonged to central Kerala and were avid fish eaters. 81(72.97%) reported that they consumed fish every day. More than half of them consumed a quantity of at least 50 gms per day. Average calcium intake from fish alone was calculated as 125.67$\pm$ 61.36 mg per day.

Only 34(30.6%) consumed ragi in Kerala. Mean calcium obtained from ragi was 50.67$\pm$78.76 mg per day. Leafy vegetables were consumed regularly by only 16 (14.4%) of them. Mean + sd (mg) was 19.42$\pm$15.69. 26 (23.42%) patients consumed nuts regularly. Mean

+sd(mg) was 40.03±38.11. Nearly 90% of our patients did consume milk but only 14(12.61%) were taking at least 500 ml of milk per day.

16 (14.41%) ladies said that they did not consume milk as they were never advised and ten of them (9%) did not think drinking milk was important. Several of them had various other reasons for not being on milk (table 1). Mean calcium obtained from milk was 240.74±181.13 mg.

Overall dietary calcium intake of our patients ranged from as low as 112 mg to 1150 mg. Mean daily dietary calcium intake was 474.55 ± 222.73 mg. (table 2)

Mean ± SD of PTH was 81.56 ± 46.76 pg/ml, that of ALP was 91.6 ± 36.95 , phosphorous: 3.75 ± 0.71, calcium :9.2 ± 0.772, Vitamin D : 28.32 ± 21.74 pg/ml. Mean ± SD of BMD from our institute was 0.971 ± 0.173 gm/cm^{2}at the lumbar spine and 0.912 ± 0.134 gm/cm^2 at the left femoral neck.(Table 3)

Though professionals seem to be more regular in taking calcium supplements, there was no statistically significant association seen with education and dose of calcium. Similarly there was no association between education and regularity of calcium. Milk intake was also not associated with educational level.

Responses to OKAT Questionnaire: Correct responses to the OKAT as per the original article on the same was tabulated as percentage of correct responses (Table 4). It is evident that the basic knowledge regarding osteoporosis is less than expected from an educated society. There is suboptimal awareness regarding treatment of osteoporosis as well. Only nine percent of our subjects were aware of the availability of treatment for osteoporosis. Awareness of a higher peak bone mass being helpful in prevention of osteoporosis was also not optimal among our people. However general awareness of osteoporosis and advancing age increasing fracture risk, and the benefit of physical activity in preventing osteoporosis was seen in nearly 80% of our subjects.

Discussion

This study was undertaken to assess the level of awareness of osteoporosis, dietary calcium, diary intake and misconceptions among educated postmenopausal women in a teaching hospital in Kerala. This has given some insight regarding lack of awareness about osteoporosis and calcium intake - both nutritional as well as supplements. This study also demonstrates the inadequate calcium intake of postmenopausal women.

The state of Kerala is well known for its literacy, educational status as well as social equality. Also Kerala is rated as one among top performing states to comply with the United Nations' Sustainable Development Goals in India as well as in NITI Aayog's Education as well as health Index. Kerala also has a lesser nutritional gap between rich and poor and is also a state where there is reverse discrimination in favor of the girl child. With all this, we assumed that the awareness and nutrition would be better among the educated women of Kerala. Hence we had defined our study subjects as those who had completed at least a higher secondary level of education and belonged to the high SES group. We also wanted them to be active physically, thus excluding any comorbid condition that would affect their nutrition or bone density. However these criteria excluded more than 75% of the postmenopausal women who visited us during the study period and included only 111 patients. The data derived from these women has shown us the reality of dietary calcium intake, knowledge and awareness of osteoporosis as well as misconceptions among the educated women of Kerala.

Forty percent of our study participants were not aware about osteoporosis and less than half had received any medical advice regarding calcium intake after menopause. This is really of concern because, our subjects seemed well informed people, from a good economic background. However academic knowledge may not always translate to health literacy is what we gather from this study. We as physicians, while looking after our patients, often tend to assume that our affluent and educated patients are better informed regarding osteoporosis and nutrition. Hence health education given may not be optimal.

Diet in most places in India, is a carbohydrate predominant one. In Kerala, rice being the staple diet, most households are used to consuming large quantities of the same, which was probably necessary as the major source of energy in the era where most people relied on hard physical labour of agriculture. However as life style got modernized and mechanized, there was much lesser energy expenditure but the quantity of food remained the same or became even richer. This disparity in energy intake and expenditure often leads to obesity. When a postmenopausal lady is advised to consume half a litre of milk a day, she often disagrees because she feels that this will add to her obesity and worsen her osteoarthritis. Food habits have a lot to do with one's culture and it is deeply rooted. It becomes difficult to make our patients cut down carbohydrates and include milk and calcium rich food into their diet.

Also though Kerala takes pride in her coastline and fish, it is a fact that fish is expensive. Though predominantly a fish eating community, the average daily intake of fish in our study is again less than optimal. Less than 10% of RDA of calcium is obtained from fish as per our study.

Even when advised about calcium supplements, only 50 percent of our patients were actually taking it and only half among them took an optimal dose. Often our patients consider their diet to be a nutritious one and think that dietary calcium is sufficient. This and the fear of taking a medication continually is the reason why many of our patients are not on an optimal dose of calcium. However when diet was assessed with previous day and week recall technique, it was found that the daily dietary calcium intake(DCI) was less than 50% of the recommended daily allowance of calcium for postmenopausal women. Studies from other parts of India, showed a DCI of 632.72 ± 28.23 mg/day in Tamil Nadu [19] and 499.94 ± 251.5 in Karnataka [20]. It seems surprising that our study from Kerala has lesser DCI than our neighbouring states. Use of leafy vegetables and milk is much less in Kerala compared to neighbouring states. Kerala relies mostly on roots and other carb rich vegetables rather than leafy vegetables. This may be one of the reasons for such low DCI in our study.

We recommend that all postmenopausal women be advised to take at least 500 ml of low fat milk, and incorporate egg whites, almonds, leafy vegetables, ragi, as well as sea food into their diet after cutting down on carbohydrates and fats. We also advice our patients to take at least 500 mg of calcium supplements daily along with 2000 units of vitamin D. History of renal calculi and prior history of hypercalcemia are asked for and biochemical profile including serum calcium corrected for albumin, phosphorus and vitamin D levels are checked prior to supplementing calcium.

Mean vitamin D in our study was much higher and close to normal when compared to the study by Harinarayanan et al, done in 2005. Past 15 years of regular vitamin D supplementation may be the reason

for better vitamin D levels in our study. Another study by Tandon et al from Jammu & Kashmir in 2014 had shown an average vitamin D level of 26.86 ng/ml among postmenopausal women. This is close to our value of 28.32 ± 21.74 ng/ml.

Our mean BMD at femoral neck and lumbar spine were 0.912 ± 0.134 gm/cm^2 and 0.971 ± 0.173 gm/cm^2 respectively as against 0.897±0.151gm/cm^2 and 0.972±0.164 gm/cm^2 seen in the 50 -60 age group in the study by Marwah et al [21].

We used the OKAT questionnaire as this is a validated tool. But some of the questions were not devoid of ambiguity. Hence we also recommend that this tool would require validation in other populations and some modifications might be necessary to reflect regional variations.

Legend Figures & Tables

Fig. 1: Educational Status of study subjects

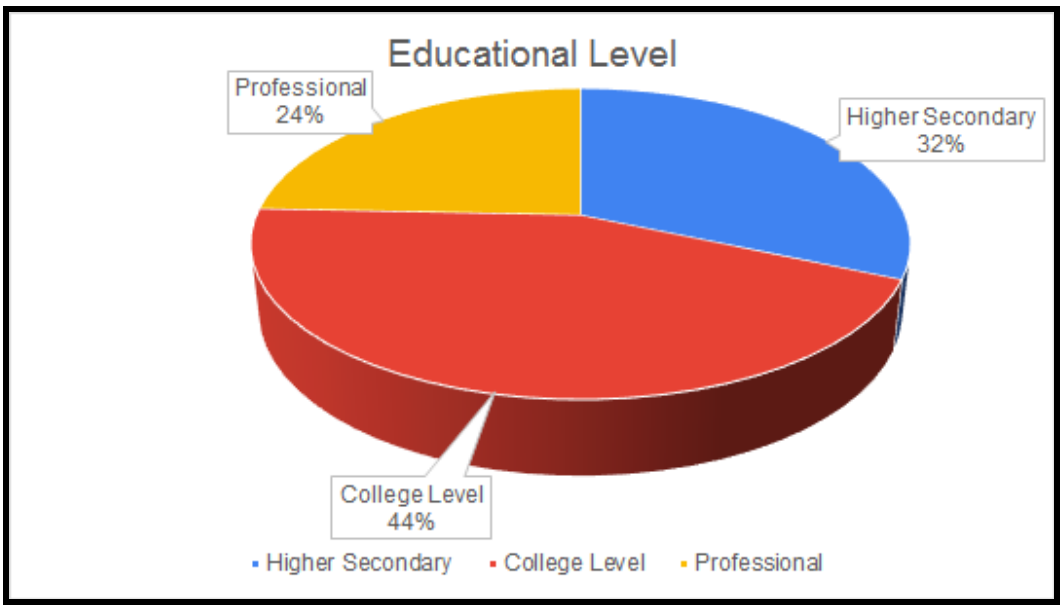

Fig.2: Calcium intake and sources of calcium

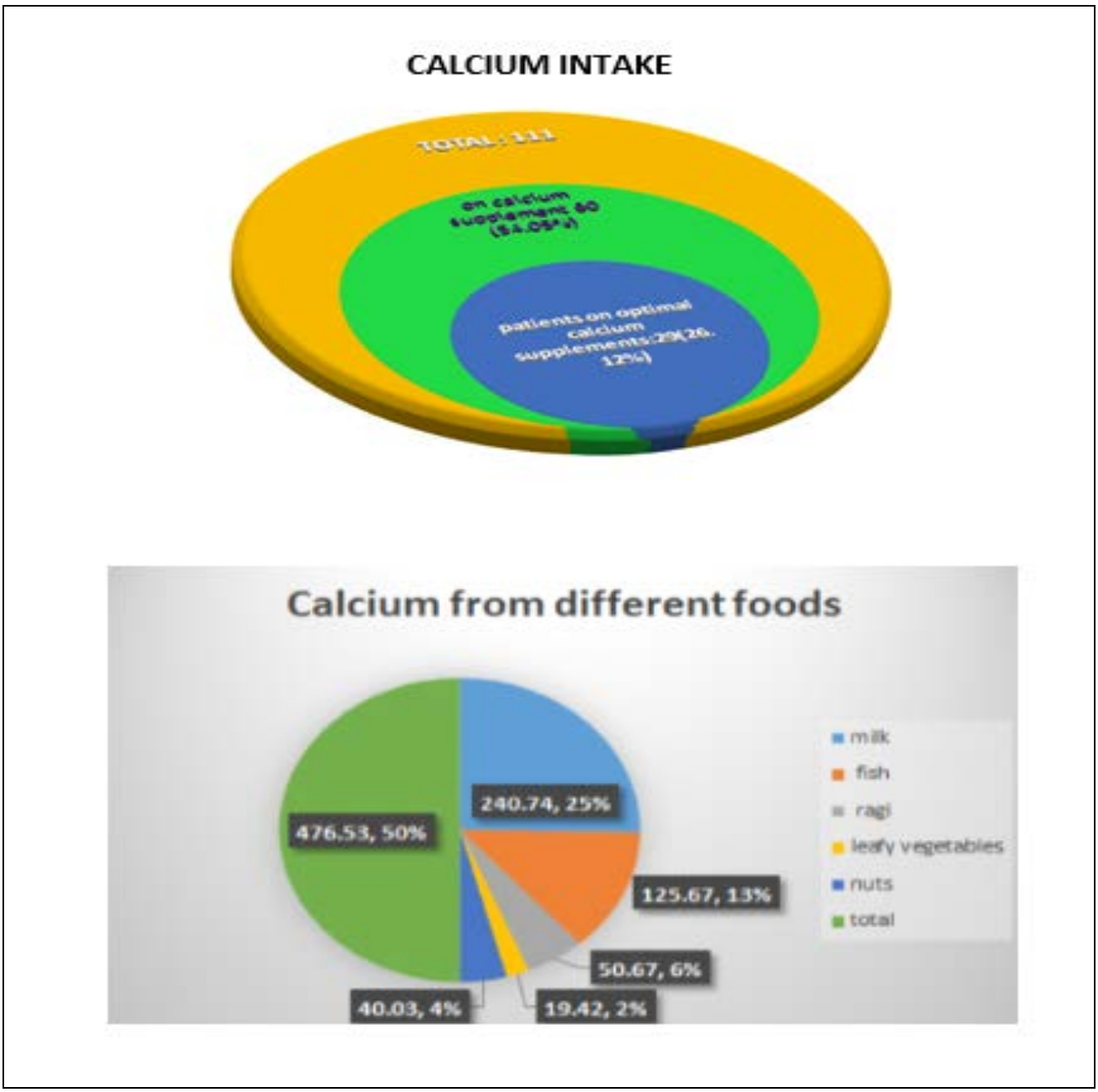

Table 1: Reasons for lack of compliance with milk and calcium supplements (most common for not taking calcium or milk was lack of medical advice)

Reasons For Lack Of Compliance	Milk (Number Of Patients)	Calcium (Number of Patients)
Never Been Advised	16	44
Doesn't think it as important	10	33
Gastritis or intolerance	12	1
Cost	1	3
Fear of stone	1	8
Frightened by someone	5	3
Social media	0	1
Quantity is too much	1	1
Blood test showed normal calcium	NA	1

Table 2: Dietary Calcium from Various Sources

Source of Food	Average Daily Calcium Obtained	Percentage of RDA	Percentage of Subjects Taking It.
Milk	240.74±181.13 mg	24%	98 (88.2%)
Fish	125.67± 61.36 mg	12.5%	81(72.97%)
Ragi	50.67±78.76 mg	5%	34(30.6%)
Nuts	40.03±38.11	4%	26 (23.42%)
Leafy Vegetables	19.42±15.69	1.9%	16 (14.4%)
Average Total Calcium Intake In A Day From Diet	474.55 ± 222.73	47.4%	

Table 3: Biochemistry And BMD

Parameter	Mean ± SD (normal range)
PTH	81.56 ± 46.76 pg/ml (10-65)
ALP	91.6 ± 36.95U/L (30 - 120)
phosphorous	3.75 ± 0.71mg/dL (2.50 - 4.50)
calcium	9.2 ± 0.772 mg/dL (8.70 - 10.70)
Vitamin D	28.32 ± 21.74 ng/ml (30-100)
BMD at the lumbar spine	0.971 ± 0.173 gm/cm^2
BMD at the left femoral neck	0.912 ± 0.134 gm/cm^2

Table 4: OKAT questionnaire with percentages of correct responses.

Sn.	Items	Correct Answer	Percentage of Correct Answer
1	Osteoporosis leads to an increased risk of bone fractures.	True	81 (72.9 %)
2	Osteoporosis usually causes symptoms (e.g., pain) before fractures occur.	False	10 (9%)
3	Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life.	True	60 (54.05%)
4	Osteoporosis is more common in men.	False	48 (43.24%)
5	Cigarette smoking can contribute to osteoporosis.	True	34 (30.6%)
6	White women are at highest risk of fracture when compared with other races.	True	47 (42.34%)
7	A fall is just as important as low bone strength in causing fractures.	True	64 (57.65%)
8	By age 80 years, a majority of women have osteoporosis.	True	88 (79.27%)
9	From age 50 years, most women can expect at least one	True	79 (71.17%)

	fracture before they die.		
10	Any type of physical activity is beneficial for osteoporosis.	True	77 (69.36%)
11	It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors.	True	32 (28.82%)
12	Family history of osteoporosis strongly predisposes a person to osteoporosis.	True	46 (41.44%)
13	An adequate calcium intake can be achieved from two glasses of milk a day.	True	65 (58.55%)
14	Ragi and broccoli are good sources of calcium for people who cannot take dairy products.	True	84 (75.67%)
15	Calcium supplements alone can prevent bone loss.	False	43 (38.73)
16	Alcohol in moderation has little effect on osteoporosis.	True	26 (23.42%)
17	A high salt intake is a risk factor for osteoporosis.	True	25 (22.52%)
18	There is a small amount of bone loss in the 10 years following the onset of menopause.	False	3 (0.02%)
19	Hormone therapy prevents further bone loss at any age after menopause.	True	35 (31.53%)
20	There are no effective treatments for osteoporosis available in India.	False	10 (9%)

Limitations: Our study is a hospital based one and not a community study and hence the results may not be representative of the community.

Conclusions And Implications For Practice

Findings of this study shows us that even educated postmenopausal women require more awareness about osteoporosis. We also found that educational level and socioeconomic status alone is not sufficient to make changes in dietary habits which are based more on one's cultural practices. This study helps us understand that dietary calcium intake of an affluent keralite is poorer than their peers in other states. However if this translates to increased fracture risk compared to other states, it needs to be studied further. As there are several misconceptions regarding calcium supplements, we suggest that all postmenopausal women be given special advice regarding dietary calcium as well as routine calcium supplements. Since there aren't many

specialized centres or clinics that cater to the postmenopausal population, it may be a good idea to incorporate postmenopausal health into the lifestyle diseases clinics and taken up by all physicians, gynaecologists, orthopedicians as well as endocrinologists. Also, as social media use has become widespread across all sections of the society, health education and awareness programmes may be done more effectively using these platforms.

Abbreviations

1. OKAT: Osteoporosis Knowledge Assessment Tool
2. BMD: Bone Mineral Density
3. SES: Socio Economic Status
4. BMI: Body Mass Index
5. SD: Standard Deviation
6. DCI: Dietary Calcium Intake

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