

## Original Research Article

# A COMPARATIVE STUDY TO EVALUATE THE SERUM CALCIUM AND ALP LEVEL IN POSTMENOPAUSAL AND PREMENOPAUSAL WOMEN

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### ABSTRACT

**Background:** Calcium Ion is a vital Mineral in the human body regulated by a number of hormones like Parathyroid Hormone, Vitamin D and Calcitonin. During menopause, hormonal changes particularly the decline in Estrogen, can have a significant impact on bone health. Bone-specific ALP concentration in serum rises only in cases of increased remodelling of bone. **Aim & Objectives:** The study is aim to assess the serum calcium level and ALP level in the postmenopausal women compared to premenopausal women.

**Materials and Methods:** 100 premenopausal women of age group 20-40 years and 100 postmenopausal women of age group 45-70 years were included in this study. Blood samples were collected and selected bone markers like serum calcium and ALP level analysed in the Biochemistry Diagnostic Laboratory. Statistical analysis was done using SPSS software.

**Results:** The serum calcium level is decreased in the post-menopausal women ( $7.15 \pm 0.86$ ) as compared to the premenopausal women (mean  $8.90 \pm 1.20$ ) with significant p value  $<0.004$ . The ALP level is increased in the post-menopausal women (mean  $194 \pm 41.34$ ) compared to premenopausal women (mean  $78 \pm 31.51$ ) with significant p value 0.02.

**Conclusion:** In the present study showed that there is a significant decrease in serum calcium level and increase ALP level in the postmenopausal women due to hormonal changes like withdrawal of estrogen hormone and bone mass reduction. There should be early detection of the serum calcium level for therapeutic purpose and follow up management.

**Keywords:** ALP (Alkaline Phosphatase). Menopausal, Hormonal changes.

## INTRODUCTION

Calcium Ion is a vital Mineral in the human body, primarily known for its role in maintaining strong bones and teeth. However, it also plays critical roles in other biological functions. Extracellular calcium ion concentration is determined by the interaction of calcium absorption from the intestine, renal excretion of calcium, and bone mineralization and rate of bone turnover of calcium. It is regulated by a number of hormones like Parathyroid Hormone, Vitamin D and Calcitonin.<sup>[1]</sup> There are two major causes of bone resorption are oestrogen deficiency and age related processes.<sup>[2]</sup>

Alkaline phosphatase (ALP), a homodimeric protein with phosphorylating properties exist in many isozyme forms, the most common of them being tissue non-specific ALP. The two isoforms of tissue non-specific ALP, liver-specific ALP and bone-specific ALP (BALP) exists in almost equal proportion in serum.<sup>[3]</sup> Physiologically, BALP adheres to osteoblastic cell membrane with only small amount released in serum. Its concentration in serum rises only in cases of increased remodelling of bone.<sup>[4]</sup> The tissue mineralization stimulating effect of BALP is achieved mainly through inactivation of pyrophosphate and osteopontin, which are themselves mineralization inhibitors.<sup>[5]</sup>

Serum Calcium and ALP are the bone turnover markers which help in bone formation and mineralization. Osteoporosis is one of the most important health problems in postmenopausal women which reduces the quality of life.

During menopause, hormonal changes particularly the decline in Estrogen, can have a significant impact on bone health, including calcium regulation in the body. Estrogen helps protect bone density by inhibiting interleukin IL-6 production, which reduces bone resorption and also controls the timing of osteoclast apoptosis. Estrogen inhibits bone resorption by regulating the receptor activator of NF- $\kappa$ B ligand (RANKL) and osteoprotegerin (OPG). Estrogen promotes the expression of OPG which suppresses the RANK receptor on osteoclasts. Estrogen can increase calcium absorption by stimulating the kidney to produce 1- $\alpha$  hydroxylase. When Estrogen levels decrease during Post-menopause, the intestinal calcium absorption decreases and cancellous as well as cortical bone loss accelerates, increasing the risk of osteoporosis and fractures. With the onset of Menopause, rapid bone loss occurs around 2% to 3% over the 5-10 years.<sup>[6]</sup>

## MATERIALS AND METHODS

The data was collected from the Laboratory information system established in the clinical biochemistry laboratory, GMERS Medical College

and Hospital, Sola, Ahmedabad. Total 100 Premenopausal and total 100 Post-menopausal women were included in this study. Ethical Committee approval was taken.

**Inclusion Criteria:** the women aged between 20 to 40 years Premenopausal state and 45 to 70 years Post-menopausal state were included in this study

**Exclusion Criteria:** Patient with history of major illness like Hypertension, Diabetes mellitus, other endocrine disorders, hysterectomy, patient on hormone therapy, bone fractures and thyroid medication were excluded in this study.

**Method:** Majority of the patients belong to lower middle socio-economical class.

**Procedure:** In each subject, 3-5 ml of venous blood was collected in a Gel tubes with aseptic precautions from the antecubital vein. Tubes was properly labelled and referred to the clinical biochemistry laboratory for the estimation of calcium and ALP level in serum. In the laboratory, after clot formation, Blood serum was separated after centrifugation method. Calcium was measured by the Arsenazo III method in the ERBA -360 Fully Automated Chemistry Analyzer. Normal reference range for serum Calcium level was between 8.6 to 10.2 mg/dl. ALP was measured by Enzymetic method in the ERBA-360 Fully automated Chemistry Analyzer. Normal reference range for serum ALP level in 20-59 years was 42-98 U/l and >60 years was 53-141 U/l. Statistical Data was analysed by SPSS software.

## RESULTS

**Table 1: Comparison of mean calcium and ALP levels in both groups**

Variables	Premenopausal Mean $\pm$ SD	Postmenopausal Mean $\pm$ SD	P value
Calcium (mg/dl)	8.90 $\pm$ 1.20	7.15 $\pm$ 0.86	<0.004
ALP (U/L)	78 $\pm$ 31.51	194 $\pm$ 41.34	0.02

In Table 1 describe the serum calcium and ALP levels in pre-menopausal and post-menopausal women. In premenopausal women age group 20-40 years, serum calcium level was mean 8.90  $\pm$  1.20 and ALP level mean 78  $\pm$  31.51. In postmenopausal

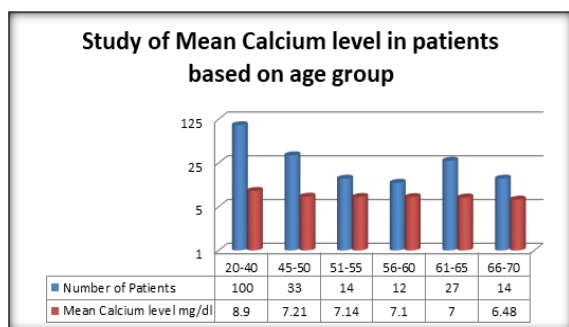
women age group 45-70 years, serum calcium level was mean 7.15  $\pm$  0.86 and ALP level mean 194  $\pm$  41.34 The p value for serum calcium was <0.004 and for ALP level 0.02 which was highly significant.

**Table 2: Study of Mean Calcium level in patients based on age group**

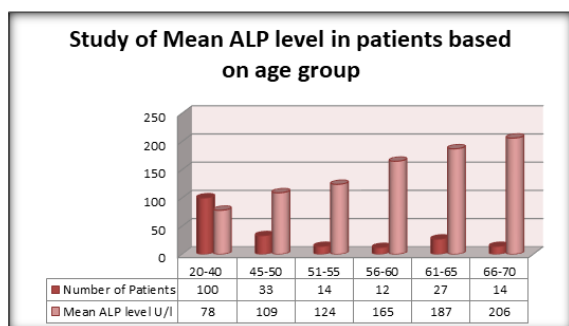
Age Group (Years)	Number of Patients	Mean Calcium level mg/dl	Mean ALP level U/l
20-40 (Premenopausal)	100	8.9	78
45-50	33	7.21	109
51-55	14	7.14	124
56-60	12	7.10	165
61-65	27	7.0	187
66-70	14	6.48	206

In Table 2 describe the mean serum calcium and ALP levels in different age group patients. In 20-40 years age group, there were included 100 Patients and their mean calcium value was 8.90 mg/dl, in 45-50 years age group 33 Patients and their mean calcium value was 7.21 mg/dl, in 51-55 years age group 14 patients and their mean calcium value was 7.14 mg/dl, in 56-60 years age group 12 patients and

their mean calcium value was 7.10 mg/dl, 61-65 years age group 27 Patients and their mean calcium value was 7.00 Mg/dl and 66-70 years age group 14 patients and their mean calcium value was 6.48 mg/dl.



**Figure 1: Study of Mean Calcium level in patients based on age group**



**Figure 2: Study of Mean ALP level in patients based on age group**

## DISCUSSIONS

In our study to evaluation of serum calcium and ALP level in Premenopausal and Postmenopausal women. The serum calcium level had decreased in the post-menopausal women ( $7.15 \pm 0.86$ ) as compared to the premenopausal women (mean  $8.90 \pm 1.20$ ). The serum calcium level had decreases with the increase of the age group of the patients. The ALP level had increased in the post-menopausal women (mean  $194 \pm 41.34$ ) compared to premenopausal women (mean  $78 \pm 31.51$ ). The findings of our study had been correlated with the other studies (7, 8, 9, 10, 11 & 12). In some of the study, serum Calcium levels were significantly higher in postmenopausal women compared to premenopausal women which is not correlated to our study (14, 15 & 16).

In Bhatrai et al. study,<sup>[7]</sup> decreased serum calcium levels in the post-menopausal group  $8.73$  (SD  $0.60$ ) when compared to the pre-menopausal group  $9.65$  (SD  $0.68$ ) and ALP level slightly higher ( $P = 0.046$ ) in the post-menopausal group  $111.86$  (SD  $66.5$ ) when compared to the pre-menopausal group  $82.40$  (SD  $78.50$ ) is key marker of bone mass reduction. It is due to decreased estrogen levels resulting in increased synthesis of cytokines by osteoblasts, monocytes and T cells and stimulates bone resorption.

In Bikram Khadka et al,<sup>[8]</sup> study showed the statistical association was found with the reduced serum calcium levels among postmenopausal women (mean  $8.53 \pm 0.619$ ) Vs. pre-menopausal women (mean  $9.23 \pm 0.793$ ) and increase in serum

ALP among postmenopausal women (mean  $106.76 \pm 40.85$ ) Vs. premenopausal women ( $85.20 \pm 31.26$ ) suggesting an elevated bone turnover result in bone mass reduction.

In Lekhi et al,<sup>[9]</sup> study from Nepal had also showed moderately reduced serum calcium ( $2.05 \pm SD0.11$ ) in postmenopausal women as compared to ( $2.22 \pm SD0.20$ ) premenopausal women and slightly increased serum ALP in ( $226.44 \pm 44.36$ ) early postmenopausal women as compared to premenopausal women ( $211.16 \pm 37.35$ ).

In Patwa et al study<sup>10</sup>, the serum calcium levels were significantly reduced in the postmenopausal group  $8.96$  mg% (SD  $0.66$ ) when compared to the pre-menopausal group  $9.49$  mg% (SD  $0.63$ ) which is similar to our study results. She explained declining ovarian function during menopause is accompanied by decrease in bone mass and altered calcium metabolism. In Postmenopausal women monitored for serum calcium levels for reducing risk of thyroid dysfunction.

In Bhale et al study,<sup>[11]</sup> shows that Postmenopausal women had significantly lower calcium levels than in premenopausal women. The reduction in skeletal mass caused by an imbalance between bone formation and bone resorption due to loss of ovarian function and oestrogen deficiency induce calcium loss due to decreased intestinal calcium absorption and decreased renal calcium conservation.

In Praveen Shabir et al study,<sup>[12]</sup> there is a considerable reduction in calcium in postmenopausal women indicates negative calcium balance due to multifactorial phenomenon. It is not only related with nutritional status but withdrawal of estrogen hormone.

In Qureshi et al,<sup>[13]</sup> studied in Pakistan found significantly lower serum calcium and higher serum parathyroid hormone levels in postmenopausal women indicating increase bone turnover compared to premenopausal women. Serum calcitonin level was not significantly different in the two group. Alteration in mitochondrial oxidation during menopause is associated with lipotoxicity and increased cardiovascular risk, mediated by the decline in estrogen in menopause.

In Muni Radha Jadaa et al,<sup>[14]</sup> study showed slightly higher mean serum calcium among postmenopausal group compared to premenopausal women. They found significantly reduced bone density in postmenopausal women

In M. Suresh et al,<sup>[15]</sup> found statistically no significant difference between serum calcium levels in both the groups. The decreased bone resorption risk in late postmenopausal women might be due to increased FSH levels

In C.V. Harinarayan et al,<sup>[16]</sup> from south India studied vitamin D and BMD found prevalence of osteoporosis was much lower in the young reproductive women than in postmenopausal women. There was no significant difference found in serum calcium levels between both the groups.

## CONCLUSION

In the present study showed that there is a significant decrease in serum calcium in the postmenopausal women due to hormonal changes like withdrawal of estrogen hormone and increase ALP level among the normal postmenopausal women compared to premenopausal women due to elevated bone turnover results in a bone mass reduction occurs. There should be early detection of the serum calcium level for reducing the risk of osteoporosis. It can be very useful tool for the postmenopausal women in therapeutic purpose and follow up management.

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