

# Study of Serum Calcium Levels in Premenopausal and Postmenopausal Women

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## ABSTRACT

**Background:** Menopause is the permanent cessation of menstruation seen in women between 40-61 years of age. Menopause is characterised by reduction in ovarian hormone production. Oestrogen deficiency and age related processes cause decrease in calcium levels in post menopausal women.

**Aims and Objectives:** To study serum calcium levels in premenopausal and post menopausal women.

**Materials and Method:** Cross sectional study was conducted. 35 pre menopausal and 30 post menopausal women were selected according to inclusion and exclusion criteria . Patients with medical history of major systemic diseases, women on hormone replacement therapy, and women who had surgical menopause were not included in the study .Serum calcium levels were estimated in both groups. For statistical analysis the value of laboratory parameters were presented as the Mean±SD (standard deviation). A Student's t-test was used for cross-sectional comparisons of continuous variables between the groups.

**Results:** Serum calcium levels were significantly lower in post menopausal women than in pre menopausal women.

**Conclusion:** Post menopausal women are calcium deficient.

**Keywords:** Premenopausal women, postmenopausal women, Menopause, serum calcium.

## INTRODUCTION

Menopause is permanent cessation of menstruation, seen in women between 40-61 years of age. It is characterised by the menstrual changes that reflect oocyte depletion and subsequent reduction in ovarian hormone production. Menopause typically occurs in middle age, 40-61 years of age, signalling the end of the fertile phases of life<sup>1</sup>. Menopause is characterised by hot flushes, night

sweats and various other psychological and biochemical changes . It also leads to metabolic bone disorders .With the onset of menopause, rapid bone loss occurs which is believed to average 2 to 3 % over the following 5 to 10 years, being greatest in the early post menopausal years<sup>2,3</sup>. Calcium ion is an essential structural component of skeleton. Body cannot synthesize it. Nutrition imbalance with endocrine abnormalities may be involved in osteoporosis<sup>4</sup>. Extracellular calcium ion concentration is determined by the interaction of calcium absorption from intestine, renal excretion of calcium and bone uptake and release of calcium , each of which is regulated by parathormone, vitamin D and calcitonin<sup>5</sup>. Estrogen deficiency is present in post menopausal women. Estrogen deficiency results in longer life span of osteoclasts<sup>6</sup>.This estrogen deficiency is reason for

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osteoporosis seen after menopause. The female sex hormone diminish to almost none after menopause. Bone turnover increases to high levels in women soon after menopause. The 2 main causes of bone loss are estrogen deficiency after menopause and age related process<sup>7</sup>. Intestinal calcium absorption decreases in post menopausal women<sup>8</sup>. Osteoporosis is a late complication of menopause. It is a degenerative bone disorder where there is thinning and weakening of the bone and a general decrease in bone mass and density. So susceptible to fractures. Fractures related to osteoporosis are estimated to affect around 30% of women in developed countries and are a major health problem. Normally bone will go through a process where old bone is replaced by new bone cells. Our body's ability to handle this process changes with age. Estrogen is involved in the process of calcium absorption into the bones. During menopause there is a drop in estrogen levels. All women will experience acceleration in bone density reduction as their estrogen levels drop. Menopause in elderly women is associated with accelerated loss of cortical bone. Rapid bone loss occurs when the balance between formation and resorption is upset resulting in a negative remodelling balance and leads to osteoporosis. It is mainly due to imbalance in hormonal factors like estrogen, prolactin and changes in bone formation markers like calcium, phosphorus. The decrease in the level of sex steroid hormones during menopause in women causes various somatic, vasomotor, sexual and psychological symptom. The risk of osteoporosis, cardiovascular disease, arterial hypertension, impairment of glucose metabolism, and degenerative cognition disease incidence rises. The impact of deficiency of female sex hormones after menopause on the trace minerals has not been widely studied but expected menopause related changes in their status may have an impact on the above pathologies. There are very few reports on the changes in serum calcium and magnesium levels in various phases of the menstrual cycle in otherwise healthy women. Estrogen induces hypercalcemia through the action of the parathyroid gland. Withdrawal of estrogen is reported to cause a significant loss of bone calcium. Increase in serum calcium levels during the follicular and ovulatory phases could be due to the effect of estrogen on the parathyroid glands. In addition to bone calcium content the level of serum calcium appears to be associated with blood pressure, and could be a metabolic risk factor for cardiovascular disease. The study was carried out to evaluate calcium status in pre and post menopausal

women.

## MATERIALS AND METHOD

Cross sectional study was conducted in 35 pre menopausal women (25-45 years of age) and 30 post menopausal women (46-65 years of age) in department of Physiology. Subjects were selected from general population according to the inclusion criteria. Consent was taken from subjects and procedure was explained to subjects.

**Inclusion criteria** : Post menopausal women between age 46-65 years.

**Exclusion criteria** : 1) Surgical menopause due to hysterectomy

2) Post menopausal women on estrogen therapy

3) Women having Diabetes / Hypertension.

Collection of blood sample 5 ml of venous blood was drawn aseptically from each subject. It was centrifuged at 3000rpm for 10 minutes and serum was separated. Serum calcium levels were estimated by photocalorimetry method.

### Statistics

Student t test was applied to see the significance of difference of parameters between 2 groups. Mean and standard deviation of variables was determined. Correlation was done by using Pearson's correlation coefficient. The interpretation of P value are as follow

P > 0.05 - not significant

P < 0.05 - significant

P < 0.01 - highly significant.

## FINDINGS

The table shows that age of pre menopausal women was  $36.73 \pm 3.8$  years (Mean  $\pm$  SD). Age of post menopausal women was  $53.64 \pm 6.30$  years (Mean  $\pm$  SD).

Serum calcium levels in post menopausal women were less as compared to premenopausal women and this was statistically significant (P=0.037). It is observed that serum calcium levels are low in post menopausal as compared to pre menopausal women.

**Table : Serum calcium levels in pre-menopausal and postmenopausal women**

Parameter	Pre menopausal women n = 35	Post menopausal women n = 30	P value
Age(years)	36.73 ± 3.8 years	53.64 ± 6.30 years	----
Serum Calcium(mg/dl)	10.07 ± 0.66 (mg/dl/)	8.4 ± 0.076 (mg/dl)	0.037

## DISCUSSION

Calcium ion is an essential structural component of the skeleton. Estrogen deficiency after menopause induces calcium loss by indirect effects on extra skeletal calcium homeostasis as well as decreased intestinal calcium absorption. When estrogen is deficient, there is an increase in the activation of new bone remodeling units. Both formation and resorption are altered with the result that resorption exceeds formation, producing a negative balance. Estrogen deficiency may induce calcium loss due to decreased intestinal calcium absorption and decreased renal calcium conservation. The results of the present study indicated that the level of serum calcium declined significantly in post menopausal women.

In this study serum calcium was evaluated in premenopausal and postmenopausal women. Serum calcium was significantly lower in postmenopausal women as compared to premenopausal women. Lower calcium levels after menopause lead to osteoporosis. Osteoporosis is late complication of menopause. Osteoporosis causes thinning and weakening of bone and general decrease in bone mass and density. So menopausal women are susceptible to fractures. Fractures related to osteoporosis are estimated to affect around 30% of women both in developing and developed countries and are major health problem <sup>9</sup>. During menopause there is drop in estrogen levels which caused decreased calcium levels in postmenopausal women. All women will experience acceleration in bone density reduction as their estrogen levels drop. Thus serum calcium could be used as indicator of increased bone turnover, to enable early intervention so as to minimize fractures due to osteoporotic changes <sup>10</sup>. The variation of serum calcium with age is proposed to be explained by alterations in levels of serum albumin to which approximately 40% of circulating calcium is bound and which was not adjusted for the study along with the modification of the resorption, excretion and reabsorption of calcium.

Studies have demonstrated that in addition to low estrogen levels, osteoporotic postmenopausal women had kidneys that did not reabsorb as much calcium as the kidneys of women without osteoporosis. Comparable to few other study series our study also had significantly reduced serum calcium in the postmenopausal group when compared to the premenopausal group

## CONCLUSION

Serum calcium levels are decreased in postmenopausal women. The similar results have been found in many other studies<sup>11-15</sup>. We have used cross-sectional analyses to compare postmenopausal women with premenopausal women. Although cross-sectional investigations may provide clues regarding the effects of the menopause on the physiological and biochemical changes, confounding factors such as age, ethnicity, average energy intake, physical activity, serum albumin levels etc., have to be adjusted for statistical procedures to find out the changes in the variables independent of these factors. The present study revealed that the differences between the mean values and standard deviations of the variables in the premenopausal and postmenopausal groups were small; thus making large samples necessary to detect these differences. Our premenopausal group included few perimenopausal subjects also. Thus in order to establish standard reference values and formulate predictive equations, a representation of the whole population needs to be studied. Further large scale multicentric and longitudinal studies are required to further determine the actual changes in BMI, serum levels of magnesium and calcium, and correlation or independent association between them for their clinical implications in various disorders with transition of age, and passage of menopause which is inevitable in every woman's life. It can be recommended that calcium supplementation can be given as prophylaxis to prevent the long term bone loss and to decrease the risk of fracture and osteoporosis in postmenopausal women.

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**Ethical Clearance:** Done

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