

The Effect of Calcium Supplementation in Postmenopausal Women and Changes in Serum Calcium and Phosphorus Level

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ABSTRACT

Objective: To assess the effect of calcium supplementation in postmenopausal women and changes in serum calcium and phosphorus level.

Design: Randomized controlled study at Chaudrey Rehmat Ali Memorial Trust Teaching Hospital.

Patients and method: 98 postmenopausal women for 12 months period duration. Patients were randomly divided into two groups. Subjects in Calcium Supplemented Group (CSG) were to take calcium supplement (1200mg/day) while the Control Group were not given any placebo and advised to continue with their regular diet.

Result: The study showed that calcium supplementation increased daily intake of calcium amongst the subject which maintained the serum calcium level within normal range. The serum magnesium and phosphorus level in this study were kept at a normal range although there is a slight decrease in serum phosphorus levels may be due to a reduction in the daily intake of the mineral.

Conclusion: Calcium supplementation significantly slowed the process of bone loss in postmenopausal women and helps to maintain serum calcium level.

Keywords: Calcium supplements, serum calcium, magnesium, phosphorus Postmenopausal.

INTRODUCTION

Among Postmenopausal women osteoporosis is one of major presentation, and the role of nutritional factors in the etiology of osteoporosis is controversial. However adequate nutrition does influence all aspects of bone health throughout human life cycle. Calcium is particularly important in elderly women because low dietary intake have been associated with reduced bone mineral density (BMD)^{1,5}. Postmenopausal women need to obtain sufficient amounts of calcium to maintain bone health and suppress parathyroid hormone (PTH)^{8,10}. In addition to its function in building and maintaining bones and teeth, calcium also has numerous metabolic roles in cells and in other tissues^{13,20}. Even though only small amounts of calcium required for these roles, it also gives a big impact to the calcium homeostasis. Calcium intake is particularly related to calcium balance and calcium supplementation benefits cortical bone mass.

The use of calcium supplements in the form of pills, chewable tablets and other formulation has increased because of increased awareness of the community about effects of calcium deficiency on bone health. Phosphorus and magnesium are among minerals that have been proposed as having an

important role in bone metabolisms. Phosphorus, as phosphates combine with calcium ions to form hydroxyapatite, the major inorganic molecule in teeth and bones. Magnesium (Mg) is an essential intracellular cation, a cofactor of many basic cellular processes, particularly those involving energy metabolisms^{8,11}. Individuals with low calcium to phosphorus serum (Ca: P serum) ratio would benefit from increasing their calcium intake from foods or supplements. Epidemiologic studies have demonstrated a positive correlation between dietary Mg intake and bone density and/or an increased rate of bone loss with low dietary intake suggesting that dietary Mg deficiency may be a risk factor for osteoporosis. Though there has been study on beneficial effect of calcium towards BMD, there are few data in regard to the biochemical status. The objective of this study was to assess the effect of long term calcium carbonate supplementation on serum calcium and phosphorus level.

MATERIALS AND METHODS

This randomized controlled study conducted at Chaudrey Rehmat Ali Memorial Trust Teaching Hospital. Calcium supplementation was advised to postmenopausal females. The Inclusion criteria was postmenopausal women for more than 5 years and aged between 50 to 65 years old and None of the women had been regular users of calcium supplements, hormone replacement therapy

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(bisphosphonate, estrogen, tamoxifen or testosterone), anabolic steroids, glucocorticoids, anticonvulsants or any other drugs known to affect calcium or bone metabolism within the past year. Women with history of bone disease and receiving therapy for osteoporosis, with symptomatic vertebral fracture, with any other medical conditions that affect bone metabolism, including hypothyroidism or hyperthyroidism, liver disease, malignancy or metabolic bone disease were excluded. Women were recruited by health screening test, out of 204 postmenopausal women assessed for eligibility for the study, only 163 fulfilled the inclusion criteria but 65 women were elected not to proceed. Thus, 98 women were selected for study and randomly assigned to calcium supplementation group (CSG) and control group (CG). Subjects in CSG received 1200 mg of elemental calcium daily as the carbonate, CaCO₃ (Caltrate, White Hall USA) while CG were not given any placebo and advised to continue with their regular diet and lifestyle. The supplemented subjects were asked to take 600mg tablets twice a day orally with water after meal in the morning and in the evening. Patients' demographic background and lifestyle were assessed using validated questionnaire. Dietary intakes were assessed using the Three-Day Food Record and analyzed using Nutritionist IV Diet Analysis Version 4.1. Compliance was assessed by tablet counts. Serum levels of calcium and phosphorus were measured. All data were collected during baseline, at 6 months and 12 months.

RESULTS

Clinical characteristics of the study subjects are shown in Table 1. Mean age of the women at baseline was 60±4 years and with a mean of 11±5 years post menopause. Physical characteristic of women were similar in both groups. There was no significant difference between group in calcium, phosphorus and magnesium intake at baseline. Mean intake for calcium among subjects were low when compared to Recommended Nutrient Intake (RNI), which recommend intake of 1000mg/day for elderly aged 50 to 65 years old. Almost 78% had calcium intake less than 2/3 of recommended value. Calcium supplementation had been found to increase daily calcium level intake among subjects in CSG (Table 2). This situation had increased calcium to phosphorus ratio from 0.5 to 2.1 for the group. However, subject in both groups had decreased their phosphorus intake (significant difference (p<0.05) from baseline) at 6 and 12 months. The serum levels determined in this study were within normal range in both groups. Serum calcium in CSG had been

significantly higher compared to CG at the end of this study. There was a decrement of -1.4% (at 12 months) in calcium serum level among subject CG. The calcium level in CSG however, had been similar to baseline level though there was a slight decrement during 6 months. PTHi level had been decreased in both group, which is significantly higher in CSG compared to CG. Dietary intake of calcium and Ca:P ratio had been found positively correlated with serum calcium level. Dietary phosphorus also had been shown to influence the Ca:P serum ratio.

Table 1: Clinical features of postmenopausal patients' correlation between dietary and serum levels

Characteristics	Control Group	Calcium supplement group
Age(years)	59.3±3.7	60.0±3.4
Duration of menopause (yrs)	10.7±4.8	11±4.8
Weight(kg)	62.9±11.8	60.9±9.9
Height(m)	1.51±0.04	1.53±0.06
BMI(kg/m ²)	27.6±5.3	26.1±4.3
Compliance%		91.7%

Table 2:

Variables	Dietary Ca	Dietary P	Dietary Ca: P
Serum Calcium	0.321	0.160	0.282
Serum Phosphorus	-0.057	-0.208	0.021
Serum Ca:P ratio	0.148	0.278	0.052
Serum PTH	-0.098	-0.166	0.129

DISCUSSION

Adequate Calcium is considered a key component of any bone protective therapeutic regimen, and calcium in combination with vitamin D is necessary to attain and maintain normal bone quality and quantity and thus achieves optimum bone strength. Calcium has also been associated with beneficial effects in several non skeletal disorders, primarily hypertension, colorectal carcinoma, obesity nephrolithiasis, although the extent of these effects has not been fully elucidated. This study identified a low dietary calcium intake situation among the postmenopausal women. A low calcium intake is universally reported in Asian countries^{15,19}. Our population especially postmenopausal females should be encouraged to increase their calcium intake. The key to bone health lies in the body's calcium balance. Calcium intake is positively related to calcium balance and calcium supplementation benefits cortical bone mass, value of calcium in slowing bone loss after menopause remain uncertain, possibly because the dominant factor affecting bone metabolism in these women is their recent decline in oestrogen secretion. Calcium's vital role in intracellular communications and other

body processes require that the concentration of ionized calcium in plasma be regulated within narrow limits^{7,16}. The skeleton serves as Ca store from which the calcium can enter and exit in blood as needed. If this Ca store is not sufficient, then it will result the fragile bones of osteoporosis in which there is reduction in bone mass or density accompanied by micro architectural deterioration of the skeleton with an accompanying increase in the risk of bone fracture. Maintaining serum calcium level through sufficient dietary intake could prevent this from happening or at least would slow down one of the consequences of aging which is bone loss¹⁷. Since menopause is a critical phase in the lives of females and it evokes new chapter of discussion, controversy and concern among females and this is the duty of health care providers how to deal with these symptoms and what interventions are best for optimization of long term health of women entering menopause. This study proved that the use of calcium carbonate supplements in a daily dose containing 1200mg of elemental calcium is sufficient in helping to maintain constant serum calcium level. The suppression of PTHi occurs significantly higher in calcium group, likely in respond to the increased concentration of calcium ions in plasma as a result of increased intake. This "negative feedback" mechanism would keep the serum calcium within normal range¹³. Magnesium is needed for the normal function of parathyroid glands, and its deficiency markedly disturbs calcium homeostasis leading to hypocalcaemia^{14,18}, which explained the negative correlation between the mineral and PTH found. Postmenopausal women with osteoporosis have also been reported to have a low serum magnesium concentration^{4,9}. Serum phosphorus showed a tendency to reduce might be caused by decreased intake. Though the change was not significant, the situation should not be encouraged. Study by^{2,3}, found elderly women given calcium and vitamin D supplements, with or without anti-osteoporosis drugs developed a risk for hypophosphatemia which would prevent bone recovery process. However in this study it is likely that phosphorus intake is, in fact sufficiently high for most subjects. It is calcium that is mainly deficient in their diets. However, supplementing calcium with phosphate should be encouraged especially in elderly who tend to have a low food phosphorus intake and during the next decade the increased awareness of the importance of Calcium supplementation among the postmenopausal women will enhance its use.

CONCLUSION

Calcium supplementation amongst postmenopausal women benefits them by slowing the process of osteoporosis and increases the bone mass and sufficient intake of calcium maintains serum calcium and phosphorus level.

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