CALCIUM STATUS IN PREMENOPAUSAL AND POSTMENOPAUSAL WOMEN

Hamid Javaid Qureshi, Ghulam Hussain, Zafar Altaf Jafary*, Muhammad Usman Bashir, Naghmana Latif, Zeeshan Riaz

Department of Physiology, Services Institute of Medical Sciences, Lahore, *Multan Medical & Dental College, Multan, Pakistan

Background: In postmenopausal women, the two major causes of bone loss are oestrogen deficiency after menopause and age related processes. Bone turnover increases to high levels and oestrogen deficiency may induce calcium loss by indirect effects on extra skeletal calcium homeostasis. Objective of this study was to evaluate calcium status in pre-menopausal and postmenopausal women. **Methods:** This cross sectional study was carried out in 34 premenopausal women and 33 postmenopausal women, in Department of Physiology, Services Institute of Medical Sciences, Lahore. Height and weight of each woman were taken to find out the body mass index (BMI). Serum calcium, parathyroid hormone and calcitonin levels of each subject were determined. **Results:** Premenopausal women were obese (BMI>30 Kg/m^2) while postmenopausal women were overweight (BMI>25 Kg/m^2). Serum calcium levels were significantly lower in postmenopausal women than in pre-menopausal women, while serum parathyroid hormone levels were significantly higher in postmenopausal woman. Serum calcitonin level was not significantly different in the two groups. **Conclusion:** Postmenopausal women are calcium deficient and have increased bone turnover as indicated by increased serum parathyroid hormone levels.

Keywords: Premenopausal, postmenopausal, calcium, parathyroid hormone, calcitonin.

INTRODUCTION

Calcium ion is an essential structural component of the skeleton. There is growing evidence for the importance of nutrition in the maintenance of bones and joints health. Nutrition imbalance with endocrine abnormalities may be involved in osteoporosis.[1] Extracellular calcium ion concentration is determined by the interaction of calcium absorption from the intestine, renal excretion of calcium, and bone uptake and release of calcium, each of which is regulated by parathyroid hormone, vitamin D and calcitonin.[2]

Bone mineralization and rate of bone turnover are controlled by a number of hormones in the human body. Parathyroid hormone (PTH) causes bone resorption and helps to maintain blood calcium levels. Estrogens exert a major effect in women on bone re-modelling by inhibiting interleukin (IL)-6 production that reduces bone resorption and also controls the timing of osteoclast apoptosis. Estrogens deficiency, therefore results in a longer life span of osteoclasts.[3] In females, at the age of 40–50 years, the monthly sexual cycle becomes irregular, ovulation fails to occur during many of the cycles and ultimately there is cessation of the cycle which is called menopause. The female sex hormones diminish to almost none.[2] In women, the two major causes of bone loss are estrogens deficiency after the menopause and age related processes.[4] Bone turnover increases to high levels in women soon after menopause.[5] In addition, estrogens deficiency may induce calcium loss by indirect effects on extraskeletal calcium homeostasis.[6] Intestinal calcium absorption decreases in postmenopausal women.[7] Calcitonin reduces bone resorption and reduces bone loss. Like estrogens, calcitonin can cause a small increase in bone mass.[8] This study was carried out to evaluate calcium status in pre-menopausal and postmenopausal women.

SUBJECTS AND METHODS

This cross sectional study was conducted in 34 pre-menopausal women and 33 postmenopausal women in Department of Physiology, Services Institute of Medical Sciences, Lahore. Subjects were selected from general population according to the inclusion criteria. Women having hypertension, diabetes mellitus, history of hormone replacement therapy, hysterectomy and fractures were excluded. Informed consent from each subject was taken. Height (Cm) and weight (Kg) of each woman were determined by the standard scale to find out Body Mass Index (BMI). Five ml of venous blood was drawn aseptically from each subject. It was centrifuged at 3,000 rpm for 10 minutes and serum was separated. The serum was stored at -20^oC until used. Serum calcium was measured by colorimetric method using Randox kit. Serum parathyroid hormone and calcitonin were estimated by enzyme linked immuno-sorbent assay (ELISA).

Mean±SD of all the variables was determined. Student's *t*-test was applied to see the significance of difference of parameters between two groups. Pearson's correlation coefficient was

determined to evaluate correlation between different parameters.

RESULTS

There was non-significant (p>0.05) difference of height, weight and BMI between pre-menopausal and postmenopausal women. In premenopausal women BMI was 30.17±5.32 Kg/m^2 while in postmenopausal women, it was 27.85±5.25 Kg/m^2, (Table-1).

Serum calcium was significantly (p=0.039) lower in postmenopausal women as compared to that in pre-menopausal women. Postmenopausal women had significantly (p=0.012) higher serum PTH than in pre-menopausal women. Serum calcitonin levels did not show significant difference (p=0.266) between the two groups, (Table-2, Figure-1).

Correlation of age with serum calcium, PTH and calcitonin in both pre-menopausal and postmenopausal women were non-significant (p>0.05), (Table-3).

Table-1: Comparison of anthropometric features between pre-menopausal and postmenopausal women

Parameters	Premenopausal women (n=34)	Postmenopausal women (n=33)	*p*-value
Age (years)	36.53±3.90 (30–42)	54.85±6.25 (47–69)	-
Height (Cm)	154.62±4.84	154.70±5.35	0.949*
Weight (Kg)	72.07±12.78	66.94±13.66	0.117*
BMI (Kg/m^2)	30.17±5.32	27.85±5.25	0.076*

Values are given as Mean±SD, Range is given in parenthesis, *Non-significant

Table-2: Serum calcium, calcitonin and parathyroid hormone (PTH) in pre-menopausal and postmenopausal women

Parameters	Premenopausal women (n=34)	Postmenopausal women (n=33)	*p*-value
Serum calcium (mg/dl)	9.24±0.73	8.82±0.87	0.039*
Serum calcitonin (pg/ml)	6.4±2.96	5.7±2.08	0.266
Serum PTH (pg/ml)	30.58±19.96	55.76±51.63	0.012*

* Statistically significant; Values are given as Mean±SD

Table-3: Correlations of age with serum calcium, parathyroid hormone and calcitonin levels in pre-menopausal and postmenopausal women

	Premenopausal women (n=34)		Postmenopausal women (n=33)	
Correlation between	**r-value**	***p*-value**	**r-value**	***p*-value**
Age and serum calcium	0.003	0.057	-0.128	0.48
Age and serum PTH	0.019	0.914	-0.329	0.062
Age and serum calcitonin	-0.184	0.296	0.289	0.103

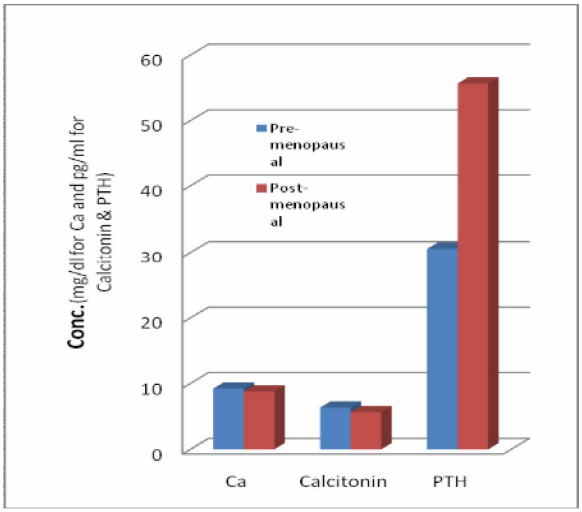

Figure-1: Comparison of serum calcium, calcitonin and parathyroid hormone (PTH) between pre-menopausal and post-menopausal women

DISCUSSION

Calcium status was evaluated in pre-menopausal and postmenopausal women in the present study. According to WHO criteria, pre-menopausal women were obese (BMI>30 kg/m^2) while postmenopausal women were overweight (BMI>25 Kg/m^2).[9]

Postmenopausal women had significantly lower serum calcium levels than in pre-menopausal women. Declining ovarian function before menopause is accompanied by reduction in bone mass and altered calcium metabolism.[10] Oestrogen deficiency may induce calcium loss due to decreased intestinal calcium absorption and decreased renal calcium conservation.[5,6]

In our study, serum parathyroid hormone was significantly higher in postmenopausal women than in pre-menopausal women. Levels of serum PTH increase progressively with age in women and correlate significantly with increase in bone turn-over.[11] Serum calcitonin levels were non-significantly lower in postmenopausal women. Calcitonin is the only hormone which binds to the osteoclast membrane and has direct anti-resorptive effect in bones.[12] Oestrogen deficiency may play a permissive role in the pathogenesis of age related increases in serum PTH and bone turn over.[13] Inadequate calcium and vitamin D lead to reduced intestinal calcium absorption, increased serum parathyroid hormone concentration and bone loss.[14]

In conclusion, pre-menopausal women were obese while postmenopausal women were overweight. Low serum calcium levels were found in postmenopausal women. Moreover these women had higher serum parathyroid hormone and lower serum calcitonin levels indicating increased bone turn over.

ACKNOWLEDGEMENT

This research project was funded by SIMS Research Grant. We are grateful to the Principal, Services Institute of Medical Sciences, (SIMS) Lahore for providing funds for this research project.

REFERENCES

1. Sheweita S, Khoshal K. Calcium metabolism and oxidative stress in bone fractures: role of antioxidants. Curr Drug Metab 2007;8:519–25.
2. Guyton AC, Hall JE. Parathyroid hormone, calcitonin, calcium and phosphate metabolism, vitamin D, bone and teeth. Text book of Medical Physiology 11th ed. Philadelphia: Elsevier Saunders; 2006.pp.901,940,978–95.
3. Garneo P, Delmas PD. Bone turnover markers. In: Encyclopedia of Endocrine Diseases. Eds Martin L. California: Elsevier Inc; 2004.pp.401–13.
4. Riggs BL, Melton LJ. Medical progress series: involutional osteoporosis. N Engl J Med 1986;314:1676–86.
5. Uebelhart D, Schlemmer A, Johansen JS, Gineyts E, Christiansen C, Delmas PD. Effect of menopause and hormone replacement therapy on the urinary excretion of pyridinium cross-links. J Clin Endocrinal Metab 1991;72:367–73.
6. Gennari C, Agnusdei D, Nardi P, Citvitelli R. Estrogen preserves a normal intestinal responsiveness to 1.25-dihydroxy vitamin D_3 in oophorectomized women. J Clin Endocrinal Metab 1990;71:1288–93.
7. Nordin BC, Need AG, Morris HA, Oloughlin PD, Horowitz M. Effect of age on calcium absorption in postmenopausal women. Am J Clin Nut 2004;80:998–1002.
8. Nieves JW, Komar L, Cosman F, Lindsay R. Calcium potentiates the effect of estrogen and calcitonin on bone mass: review and analysis. Am J Clin Nutrit 1998;67:18–24.
9. World Health Organization. Factsheet No. 311 - Obesity and Overweight. September 2006. Geneva. Available at: http://www.who.int/mediacentre/factsheets/fs311/en/index.html
10. Garton M, Martin J, New S, Lee S, Loveridge N, Milne J *et al*. Bone mass and metabolism in women aged 45–55. Clin Endocrinal (Oxf). 1996;44:563–73.
11. Eastell R, Yergey AL, Vieira N, Cedel SL. Kumar R. Riggs BL. Interrelationship among vitamin D metabolism, true calcium absorption, parathyroid function and age in women: evidence of an age-related intestinal resistance to 1, 25 $(OH)_2$ D action. J Bone Miner Res 1991;6:125–32.
12. Taboulet J, Frenkian M, Frendo JL, Feingold N, Jullienne A, de Vernejoul MC. Calcitonin receptor polymorphism is associated with a decreased fracture risk in postmenopausal women. Human Mole Genet 1998;7;2129–33.
13. Khosla S, Elizabeth J, Atkinson L, Melton III J, Riggs BL. Effects of age and estrogen status on serum parathyroid hormone levels and biochemical markers of bone turnover in women: A population based study. J Clin Endocrinal Metabol 1997;82:1522–7.
14. Dawson-Hughes B, Harris SS, Krall EA, Dallal GE. Effects of calcium and vitamin D supplementation on bone density in men and women 65 years of age or older. N Engl J Med 1997;337:670–76.

Address for correspondence:

Professor Dr. Hamid Javaid Qureshi, Department of Physiology, Services Institute of Medical Sciences, 6-Birdwood Road, Off Jail Road, Lahore, Pakistan. **Tel:** +92-42-39239232, **Cell:** +92-300-8128661
Email: hj.qureshi@yahoo.com