



Assessment of serum calcium and magnesium level in pre and postmenopausal women in Rajshahi city

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Abstract: *Background:* After menopause, the quality of life for women is one of the major health issues. In postmenopausal women, rapid bone loss occurs due to hormonal factors which is responsible for increasing risk of fractures. *Methods:* This cross-sectional type of descriptive study was carried out in the Department of Physiology, Rajshahi Medical College, Rajshahi over a period of 1 year from July 2021 to June 2022 among the 60 pre and postmenopausal women in Rajshahi city. Pre-designed, validated structured questionnaire, measuring tape, weight measuring machine and blood collection set were used to gather data. *Results:* The mean serum calcium level was not significantly decreased ($p>0.05$) in postmenopausal women but serum magnesium level was significantly decreased ($p=0.04$) in postmenopausal women in comparison to premenopausal women. *Conclusions:* Estimation of serum Ca and Mg should be done at regular basis in postmenopausal women to prevent various diseases like postmenopausal osteoporosis and cardiovascular diseases.

Keywords: Serum calcium, Serum magnesium, Premenopausal women and Postmenopausal women.

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Article at a glance:

Study Purpose: The purpose of this study was to measure and compare the serum calcium and magnesium levels in premenopausal and postmenopausal women in Rajshahi City.

Key findings: Serum calcium level was not significantly decreased but serum magnesium level was significantly decreased in postmenopausal women than premenopausal women.

Newer findings: Serum calcium and magnesium level were decreased among postmenopausal women in Rajshahi city.

Abbreviations: BMD: bone mineral density, Ca: Calcium and Mg: Magnesium.



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INTRODUCTION

Menopause is defined as the permanent cessation of menstruation and it starts with the depletion of ovarian follicles as a result of decreasing in ovarian hormones.¹ It occurs between 40-60 years of age and usually begins with irregularity of menstrual cycle which may persist up to one year till permanent cessation of menstruation.² Based on the menstrual bleeding

patterns over the previous 1 year, menopausal status is classified as premenopausal that means at least 12 menses in the past 1 year with no change in regularity. Premenopause is the whole reproductive period prior to the menopause. Menopause is the permanent cessation of menstrual cycle due to loss of ovarian follicular activity. Postmenopause is the period starting from the menopause, although it cannot be declared until

a period of 1 year of spontaneous amenorrhea has been observed.³

Various somatic, vasomotor, sexual and psychological symptoms in menopausal women occur due to decrease in the level of sex steroid hormones.⁴ During this time the risk of osteoporosis, arterial hypertension, cardiovascular disease, impairment of glucose metabolism and degenerative cognition disease incidence rises.⁵ Among different hormones in the body of women, estrogen helps to maintain bone structures throughout life. After the menopause, estrogen level decreases and poses a risk of bone disease among women.⁶ Due to bone fragility osteoporosis develops which is a multifactorial systemic skeletal disease and characterized by low bone mineral density (BMD) and micro-architectural deterioration of bone tissue.⁷ Osteoporosis also occurs due to imbalance between skeletal and extra skeletal actions. Estrogen deficiency induces an upregulation of receptor activator of nuclear factor Kappa-B ligand (RANKL) on bone marrow cells and also a decreased osteoprotegerin synthesis in osteoblasts, leading to an accelerated bone resorption.⁸

Calcium (Ca) is essential for many biological processes in the body including provision of structural support for bones and teeth, muscle contraction, signal transduction, blood clotting and enzyme regulation.⁹ Body cannot synthesize it and organ systems that play a major role in calcium metabolism are skeleton, kidney and gastrointestinal tract.¹⁰ In postmenopausal women, the estrogen deficiency induces calcium loss by indirect effects on extra skeletal calcium homeostasis and also decreasing the intestinal calcium absorption.^{11,10} Magnesium (Mg) is an important intracellular cation and all life stages; it plays a vital role in health.

Through the stimulation of the osteoclastic function, it enhances bone turn over. So, Magnesium deficiency may play a role in

postmenopausal osteoporosis. In the transport and mineralization process, it acts as a surrogate for calcium. Decreased estrogen also interferes the intestinal absorption, bone resorption and renal reabsorption of Magnesium.¹² Due to the increased risk of cardiovascular diseases and osteoporosis with age, there is necessary an increased awareness on cardiovascular diseases and osteoporosis as a major public health issue for older women.

METHODS

This was a cross-sectional comparative study in the Department of Physiology, Rajshahi Medical College, Rajshahi from July 2021 to June 2022 to assess and compare the levels of serum calcium and magnesium in premenopausal and postmenopausal women. The study population was premenopausal women aged 20-40 years and postmenopausal women aged 50-60 years residing in Rajshahi city. Prior to the commencement of the study, approval from the Ethical Review Committee (ERC) was obtained and a purposive sampling technique was used and the total sample size was 60. The questionnaire of the study was developed by consulting with the guide and reviewing the previous published literature. The respondents' selection was from neighbours, relatives and stuffs of Rajshahi medical college & hospital.

After taking informed written consent from each respondent, complete history taking and physical examination were done and recorded in preformed data sheet. Blood samples were obtained from median cubital vein in antecubital fossa making the subject to sit comfortably in a chair. Through a sterile DISPOVAN syringe under sterile precautions, about three milliliters of blood is collected in EDTA coated vacutainers. The sample was then analyzed for the serum calcium and magnesium parameters using auto analyzing machine. The statistical significance was evaluated as appropriate probability level $p < 0.05$ for all tests.

RESULTS

Table 1: Distribution of the respondents according to age (n=30 in each group)

Age of the respondents	Premenopausal women (n=30)	Postmenopausal women (n=30)
20-30 years	18 (60%)	0%
31-40 years	12 (40%)	0%
41-50 years	0%	2 (6.7%)
51-60 years	0%	28 (93.3%)
Total	30 (100%)	30 (100%)
(mean ± SD)	29.20 ± 5.99 years	54.87 ± 2.89 years

The mean age of the premenopausal women was 29.20 ± 5.99 years and the postmenopausal women was 54.87 ± 2.89 years. Obese respondents were predominantly higher in postmenopausal group

(26.7%) than premenopausal group (10%) with mean BMI of the premenopausal women was 26.46 ± 3.94 kg/m² and the postmenopausal women was 27.69 ± 2.86 kg/m².

Table 2: Distribution of the respondents according to BMI (n=30 in each group)

BMI (kg/m ²)	Premenopausal women (n=30)	Postmenopausal women (n=30)
Normal (18.5 to 24.9)	9 (30%)	5 (16.7%)
Overweight (25 to 29.9)	18 (60%)	17 (56.7%)
Obese (30 to 39.9)	3 (10%)	8 (26.7%)
Total	30 (100%)	30 (100%)
(mean ± SD)	26.46 ± 3.94 kg/m ²	27.69 ± 2.86 kg/m ²

In premenopausal group, most (83.3%) of the respondents had hypocalcemia and in the postmenopausal group, most (90%) of the

respondents had hypocalcemia. In both group none had hypercalcemia.

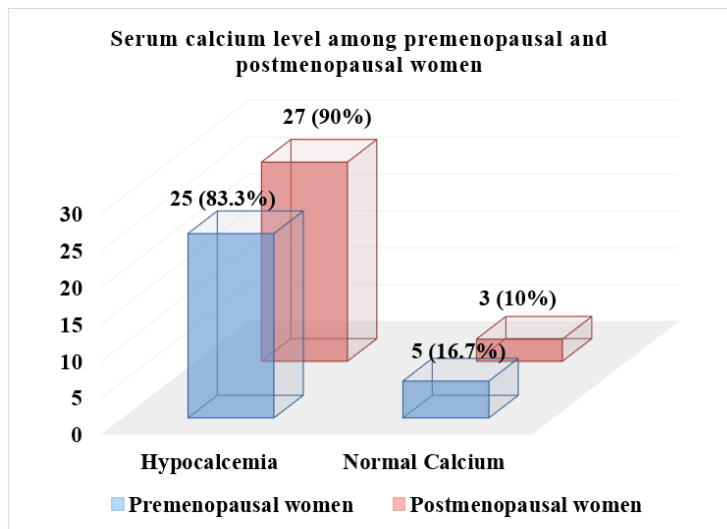


Figure 1: Distribution of the respondents according to their serum calcium level (n=30 in each group)

In premenopausal group, most (96.7%) of the respondents had normal magnesium level and in the postmenopausal group, most (93.3%) of the respondents had normal magnesium level. In

premenopausal group none had hypomagnesemia and in postmenopausal group none had hypermagnesemia.

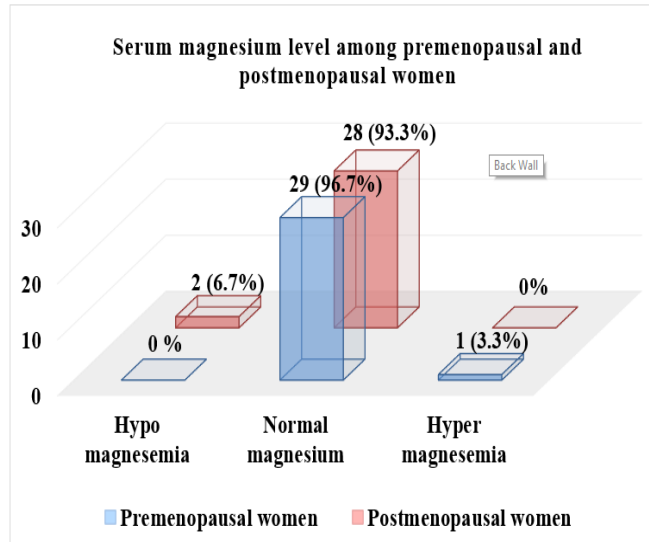


Figure 2: Distribution of the respondents according to their serum magnesium level

Serum calcium level in postmenopausal women was lower than the premenopausal women but it was not statistically significant ($p > 0.05$).

Table 3: Comparison of serum calcium between premenopausal and postmenopausal women

Serum calcium [#]	Group		t-value	p-value
	Postmenopausal women (n = 30)	Premenopausal women (n = 30)		
mean ± SD (mg/dl)	7.66 ± 0.92	7.87 ± 0.69	1.03	> 0.05
Range (mg/dl)	6.30 to 9.60	6.90 to 9.20		

(# Data were analyzed by **Unpaired t-Test** and were presented as **mean ± SD**.)

Serum magnesium level in postmenopausal women was lower than the premenopausal women and it was statistically significant ($p = 0.04$).

Table 4: Comparison of serum magnesium between premenopausal and postmenopausal women

Serum magnesium [#]	Group		t-value	p-value
	Postmenopausal women (n = 30)	premenopausal women (n = 30)		
mean ± SD (mg/dl)	2.14 ± 0.34	2.29 ± 0.24	2.03	0.04
Range (mg/dl)	1.50 to 2.70	1.90 to 2.80		

(# Data were analyzed by **Unpaired t-Test** and were presented as **mean ± SD**.)

DISCUSSION AND CONCLUSIONS

The hormonal changes are associated with menopause which are low plasma levels of estrogen and marked increase in follicle stimulating and luteinizing hormone levels.¹³ Changes in the concentrations of many blood constituents have been observed at the menopause and some of these changes can be attributed to the accelerated loss of bone mass which accompanies the menopause. These include the alteration in serum calcium and

magnesium levels.¹⁴ In this study the mean age of the premenopausal women was 29.20 ± 5.99 years and the mean age of the postmenopausal women was 54.87 ± 2.89 years.

In a study on serum bone mineralization parameters (calcium and phosphate) in pre and postmenopausal women by Ekhatior and Ebomoyi¹⁵ included total 320 respondents (40 premenopausal and 280 postmenopausal women) and mean age of

pre and postmenopausal group was 31.73 ± 11.45 years and 57.06 ± 5.57 years, respectively and this finding were near about to our study. Another study done by Bagade *et al.*¹⁶ on serum calcium levels in premenopausal and postmenopausal women where mean age of premenopausal group was 36.73 ± 3.8 years and postmenopausal group was 53.64 ± 6.30 years which were also near about to our study.

In this study the mean BMI of the premenopausal women was 26.46 ± 3.94 kg/m² and the mean BMI of the postmenopausal women was 27.69 ± 2.8 kg/m². In a study conducted by Qureshi *et al.*¹⁷ where premenopausal women were obese (BMI >30 Kg/m²) while postmenopausal women were overweight (BMI >25 Kg/m²). These findings were not similar pattern to present study. This dissimilarity might be due to two study were conducted in two different geographical regions. A study by Pardhe *et al.*⁶ summarized that the number of obese women was higher in the postmenopausal group compared to the premenopausal women. This may be due to the deteriorated lipid metabolism resulting from the reduced effect of estrogen in postmenopausal women. The above findings were nearly similar pattern to this present study.

In our study the mean levels of calcium in postmenopausal group were 7.66 ± 0.92 mg/dl and in controls was 7.87 ± 0.69 mg/dl and it was not statistically significant ($p > 0.05$). Our findings were conflicting with studies done by Saha *et al.*¹³, Sharma¹⁸, Mishra *et al.*¹⁹, Prabha *et al.*²⁰, Walia *et al.*², Bagade *et al.*¹⁶, Kumari *et al.*¹², Ali²¹, Ekhaton and Ebomoyi¹⁵, Pardhe *et al.*⁶, ELmalik *et al.*²², khadka *et al.*²³, Qureshi *et al.*¹⁷, Himabindu¹¹ where serum calcium level was statistically lower in postmenopausal group compared to control one. The cause of this dissimilarity might be in our study sample size was only 30 in each group and large sample size were necessary to detect these differences. Another reason might be in developing country like Bangladesh intake of calcium rich food and awareness about calcium requirement in premenopausal period is very less specially among women.

The mean levels of serum magnesium in postmenopausal group were 2.14 ± 0.34 mg/dl and

in controls was 2.29 ± 0.24 mg/dl. Serum magnesium level in postmenopausal group was significantly lower (mean difference -0.15, 95% CI [-0.30, -0.001]) than the premenopausal group ($p < 0.05$). These findings were in agreement with studies done by Razmandeh *et al.*²⁴, Yadav *et al.*²⁵, Mishra *et al.*¹⁹, Odabasi *et al.*²⁶, Kumari *et al.*¹², Mederle *et al.*⁸, Gür *et al.*²⁷, Kalita and Chowdhury.²⁸ Mg concentration in trabecular bone is markedly lower in osteoporotic women. The role of Mg in osteoporosis is also supported by different studies, which demonstrated that Mg supplementation can increase bone density and stops bone loss in a great proportion of subjects.⁸

Based on study findings, it was predicted that menopause have significant effect on serum Ca and Mg. Our study suggests that estimation of serum Ca and Mg should be done at regular basis in postmenopausal women to prevent various diseases. After menopause bone resorption exceeds the bone formation and the main cause behind this process is oestrogen deficiency which alter the rate of bone turnover. So, regular screening of serum Ca and Mg in postmenopausal women might be helpful for early detection of postmenopausal osteoporosis.

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Authors' contributions

LH, EAL, MMH, SM: Concept and design, data acquisition, interpretation and drafting. MP and AB: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

Declarations

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Conflict of interest: Authors declared no conflict of interest.

Ethical approval: Ethical approval of the study was obtained from the Ethical Review Committee from Rajshahi Medical College, Rajshahi. Informed consent was taken from all women. All the study methodology was carried out following the relevant ethical guidelines and regulations.

Consent for publication: Taken.

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