

## Comparison of the Serum Levels of Calcium, Phosphorus Alkaline Phosphatase Activity, and Plasma Parathyroid Hormone Betweenpre and Postmenopausal women in Khartoum-State

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### Abstract

**Background:** The aging process and hormonal changes during menopause have effect on the bone metabolism.

**Objective:** of this study was to evaluate the risk of accelerate bone mass loss by assessing bone markers such as serum calcium, phosphorus, alkaline phosphatase (ALP), and PTH in Pre and post-menopausal Sudanese women.

**Methods:** This cross sectional study was carried out in 50 Premenopausal women aged (18-40 years) and 50 postmenopausal women aged (50-80 years), during February-May 2015, Height and weight of each woman were taken to find out the body mass index (BMI). Serum calcium, phosphorus, total alkaline phosphatase, and parathyroid hormone of each subject were determined.

**Results:** Premenopausal women (BMI 19.47 Kg/m<sup>2</sup>) while postmenopausal women (BMI 20.94 Kg/m<sup>2</sup>). The mean (SD) of serum calcium, phosphorus, and alkaline phosphatase, and plasma PTH were calculated, the P-value was <0.05 for all parameters, serum calcium was significant reduce while serum phosphorus, ALP, and plasma PTH were significantly increase in postmenopausal compared with pre-menopausal women, in the postmenopausal group, the difference of the means between the early <10 year and late >10 year according to years since menopause were statistically non-significant P value >0.05.

**Conclusion:** postmenopausal women had low serum calcium, and high levels of serum phosphorus, ALP, and plasma PTH. This study suggest that postmenopausal are high risk for developing osteoporosis, bone fracture and low bone mineral density than pre-menopausal women.

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### I. Introduction

Bone metabolism is a dynamic and continuous process to maintain a balance between the resorption of old initiated by osteoclasts and the formation of new bone under the control of osteoblasts (1). Generally, the processes of bone formation and resorption are 'coupled', so that there is no net change in the bone mass. Through childhood and early adulthood, formation exceeds resorption so that bone density increases and then plateaus until the age of 30 to 40 years. After that, resorption exceeds formation and bone density decreases through the rest of life, which in turn may lead to osteoporosis (2). Biochemical markers of bone turnover have been shown to provide valuable information for the diagnosis and monitoring of metabolic bone disease (3) (4). Osteoporosis is a progressive bone disease that is characterized by a decrease in bone mass and density which can lead to an increased risk of fracture (5). In osteoporosis, the bone mineral density (BMD) is reduced, a bone structure deteriorates, and the amount and variety of proteins in bone are altered. Osteoporosis-related fractures most commonly occur in the hip, wrist or spine, it occurs when the creation of new bone doesn't keep up with the removal of old bone, also it affects men and women of all races. There is lack of information regarding the risk factors of osteoporosis in developing countries (6). So the relationships between age, menopausal age, body mass index (BMI), PTH, and several markers of bone turnover in blood total calcium, alkaline phosphatase, and phosphorus were determined in this study.

### II. Materials and Methods

This cross sectional study was conducted in 50 premenopausal women and 50 postmenopausal women in Department of clinical chemistry, Al zaiem Al Azhari University faculty Of Medical laboratory Sciences, Khartoum. 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. Based on time since menopause, 50 postmenopausal

women were categorized into 2 groups. 34 women were in their early postmenopausal period (<10years) and remaining 16 women were in their late postmenopausal period (>10years). 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 plasma, serum was separated. The serum was stored at -20oC until used. Serum calcium, phosphorus, and ALP were measured by colorimetric method using Centro norm kit. Plasma parathyroid hormone and was estimated by Use the intact PTH immune enzymatic assay TOSOH ST AIA-PACK Mean (SD) of all the variables was determined. Student's *t*-test was applied to see the significance difference of parameters between two groups. P value of ( $p>0.05$ ) considered significant.

### III. Result

There was significant difference of height, weight and BMI between premenopausal and postmenopausal women. In premenopausal women BMI was  $19.47\pm 2.06$  Kg/m<sup>2</sup> while in postmenopausal women; it was  $20.94\pm 1.731$  Kg/m<sup>2</sup>, (Table-1).

**Table 1.** Anthropometric basic characteristics between premenopausal and postmenopausal women (n=100) (value expressed as mean± SD).

Variables	Premenopausal N (50)	Postmenopausal N(50)	P-value
Age (years)	26.32±6.01	58.86± 7.84	
BMI (kg/m <sup>2</sup> )	19.47± 2.06	20.94± 1.731	0.000*

Serum calcium was significantly ( $p=0.005$ ) lower in postmenopausal women as compared to that in pre-menopausal women. Postmenopausal women had significantly ( $p=0.002$ ) higher serum PTH than in premenopausal women. Serum phosphorus, ALP levels show significant difference ( $p<0.05$ ) between the two groups, (Table-2).

**Table2.** Comparison of biochemical characteristics\* between premenopausal and postmenopausal women (n=100), (value expressed as mean± SD).

Variables	Premenopausal (control) (N=50)	postmenopausal (case)(N=50)	P-value
Total calcium (mg/dL)	8.79± .274	8.63± .275	0.005*
Phosphorus (mg/dL)	3.32±.537	3.57± .324	0.007*

The comparison of all the biochemical markers of bone turnover on early and late postmenopausal periods. Total calcium, phosphorus, and ALP levels were higher in early postmenopausal women compared to late premenopausal women statistically non-significant ( $p>0.05$ ). It was also observed that plasma PTH was low in Early postmenopausal women compared to late postmenopausal women, but it was non-significant ( $p>0.05$ ) (table 3).

**Table 3:** Comparison of markers of bone turnover in Early(<10yrs) and Late (>10 yrs.) post-menopausal period (Expressed as mean ± SD)

Parameters	Early <10 Postmenopausal Period (68%1)	Late>10 Postmenopausal Period (32%)	P-value
Age	54.32± 2.68	68.5± 6.29	
BMI	20.64± 106	21.58± 1.87	0.075
Total calcium mg/dl	8.66±.249	8.55±.318	0.179
Phosphorus mg/dl	3.58±.304	3.53±.371	0.600
ALP (u/L)	266.9± 49	254.5±27.17	0.351

#### IV. Discussion

Menopause is defined as the state of an absent of menstrual periods for 12 months due to the ovary stop to release the estrogen, this can lead to bone loss and risk factors for osteoporosis after the menopause. The present study, was evaluated the effects of menopause on calcium, phosphorus, alkaline phosphatase activity, and parathyroid hormone in healthy postmenopausal women compared to pre-menopausal women. Several authors have reported relation between menopause and fractures risk as well as low bone mineral density. In this study found calcium level is significantly lower in post-menopausal women when compared to pre-menopausal women show (table 2). This finding is consistent with other previous studies. Hamid Javaid et al. (7). Dhār wad et al. (8). Declining ovarian function before menopause is accompanied by reduction in bone mass and altered calcium metabolism (9). Estrogen deficiency may induce calcium loss due to decreased intestinal calcium absorption and decreased renal calcium conservation (10, 11). The serum phosphorus level was significantly higher in postmenopausal women compared to pre-menopausal women. Show (table 2). This is agreed with study, Shams M et al. (12). Nasser M Al-Daghri et al. (13). Phosphorus and calcium are regulated mainly by two hormones, PTH and active form of vitamin D, there for any interference with action of PTH can lead to lowering serum calcium and increase of the serum phosphorus. Serum alkaline phosphatase activity was found significantly increase in postmenopausal women (table 2). And this is agreed with study done by Kumar A et al. (14). TirthaBhatiarai et al. (15). The plasma PTH is significant higher in post-menopausal women when compared to pre-menopausal women. Show (table1). This finding is consistent with other previous studies. Hamid Javaid et al (7), A.DEPLAS et al. (16), Nasser M Al-Daghri et al. (13). PTH is not considered a bone biomarker, but it plays a key role in homeostasis of calcium and may influence skeletal health even within its clinically normal range (17).

In this study serum calcium, phosphorus, and alkaline phosphatase was statistically non-significant between the early and late postmenopausal women. Show table (3-3). This is agreeing with study done by, Indumati et al. (8). The ALP, phosphorus levels were high in women during their early postmenopausal period when compared to late postmenopausal period, calcium levels were found to be significantly increased in Early postmenopausal women compared to late postmenopausal women This shows that the bone mass continues to decline with age but at a slower rate than during the early menopausal time (18).

#### V. Conclusion

The current study conclude that the postmenopausal women had increased levels of PTH, serum phosphorus, alkaline phosphatase activity, and reduce serum calcium which effect on bone health and may represent another potential mechanism effects of the menopause on the skeleton, and may contribute the reported risk of osteoporosis and low bone mineral density among postmenopausal women.

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