



**LEVEL OF BIOCHEMICAL BONE MARKERS IN POSTMENOPAUSAL WOMEN IN  
EASTERN U.P. (INDIA): AN INDICATOR OF OSTEOPOROSIS**

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**ABSTRACT**

Present study was carried out to know the prevalence of osteoporosis in postmenopausal women in eastern part of U.P. state of India. A total of 120 postmenopausal women were included in this study. 60 nonpregnant, healthy, premenopausal women served as controls. Biochemical Bone markers such as serum calcium, serum phosphorus and serum Alkaline phosphatase were estimated in all the cases and controls to know the status of osteoporosis. Serum calcium was decreased in postmenopausal women (mean± SD 8.47±0.83 mg/dl) when compared to controls (mean±SD 9.68± 1.94 mg/dl), with 'p' value <0.05. Serum phosphorus was insignificantly (p>0.05) raised in postmenopausal women with mean ±SD level 3.82±2.62mg/dl as compared to controls (mean±SD; 3.78 ±1.57mg/dl). Serum Alkaline phosphatase levels were increased in cases with 87.36 ±18.02 IU/L compared to that of controls, 68.27± 8.12IU/L (mean±SD). This difference was statistically significant with a 'p' value of < 0.001. Thus biochemical bone markers do indicate the presence of osteoporosis in postmenopausal females of this region.

**KEY WORDS:** Osteoporosis, Postmenopause, Body Mass Index(BMI), Alkaline Phosphatase (ALP).

**INTRODUCTION**

Osteoporosis is an important public health problem in older adults. Particularly in women after menopause not only does it give rise to morbidity but also markedly diminishes the quality of life.<sup>[1]</sup> It is mainly due to imbalance in hormonal factors like estrogen, prolactin and changes in bone formation markers (calcium, phosphorus and ALP) and bone resorption markers (urinary calcium, urinary hydroxyproline)<sup>[2]</sup> Early identification of individuals at risk for osteoporosis is fundamental for effective strategies of diagnosis and treatment of osteoporosis. The postmenopausal stage in women is essentially an oestrogen- deficient state.<sup>[3]</sup> Both menopause and aging are associated with an accelerated loss of bone mass. Menopause occur when the balance between bone formation and resorption is upset. Resorption is excessive, resulting in a negative remodelling balance and leads to osteoporosis.<sup>[4]</sup>

There is lack of information regarding the risk factors of osteoporosis in developing countries. These bone markers reflect alterations in bone remodelling much earlier than they are apparent radiographically. They have untapped potential in the evaluation of patients at risk for accelerated bone loss especially in post menopausal women. This study is planned to see the

level of biochemical bone markers viz. serum calcium, serum phosphorus and serum Alkaline phosphatase in the postmenopausal women in eastern part of U.P. State of India to get an idea of prevalence of osteoporosis in this area.

**MATERIAL AND METHODS**

Present study was conducted in the Department of Biochemistry with collaboration with the Department of Obstetrics & Gynaecology and department of pathology, T.S. Misra Medical College and Hospital, Lucknow, U.P. India.

Study included 120 cases of postmenopausal women from outpatient department of Obs. & Gynae with age ranged from 46- 65 years. 60 healthy controls in age group of 18- 45 years were included in the study. Exclusion criteria for postmenopausal women were-  
Smoking

Alcoholism

Calcium supplementation

Hypertension

Diabetes mellitus

History of hormone replacement therapy, hysterectomy and fractures.

Exclusion criteria for premenopausal controls were-  
 Pregnancy  
 Smoking  
 Alcoholism  
 Oral contraceptive use  
 Informed consent was taken from each subject.  
 To calculate Body Mass Index, height (cm) and weight (Kg) of each women were noted by standard scale.  
 5ml of venous blood was collected from each subject in sterile vial after obtaining their consent. Serum was separated and stored at  $-20^{\circ}$  C immediately.

Serum calcium was estimated by Arsenazo method and Serum Alkaline phosphatase was measured by DGKC method. Both were estimated by using a complete auto analyzer, Benesphera c73. Serum phosphorus was estimated by Phosphomolybdate method using a spectrophotometer named photometer CL 63 provided by ELICO Limited.

Student 't' test was used to see the significant difference of parameters between two groups.

## RESULTS

**Table 1: Body Mass Index in Premenopausal and Postmenopausal women.**

Variables	Premenopausal (control)		Postmenopausal		P value
	Range	Mean $\pm$ SD	Range	Mean $\pm$ SD	
Age(yrs)	18-40	28.09 $\pm$ 9.14	45-65	59.60 $\pm$ 4.28	P<0.05
BMI (kg/m <sup>2</sup> )		21.71 $\pm$ 3.62		24.20 $\pm$ 5.37	P<0.05

**Table 2: Serum Calcium, Phosphorus and Alkaline Phosphatase in Premenopausal and Postmenopausal Women.**

Subjects	Serum Calcium (Mg/dl)	Serum Phosphate (Mg/ dl )	Serum Alkaline Phosphatase (IU/L)
Premenopausal(control)	9.68 $\pm$ 1.94	3.78 $\pm$ 1.57	68.27 $\pm$ 8.12
Postmenopausal	8.47 $\pm$ 0.83	3.82 $\pm$ 2.62	87.36 $\pm$ 18.02
p value	p <0.05	p > 0. 05	p< 0.001

Table 1. shows that mean age of postmenopausal women was 59.60 $\pm$ 4.28 which was significantly higher (P<0.05) than mean age of premenopausal women (28.09 $\pm$  9.14). Mean Body mass index in postmenopausal women was 24.20 $\pm$ 5.37 kg/m<sup>2</sup> which was found to be significantly higher (P < 0.05) than body mass index in premenopausal women (21.71 $\pm$ 3.62).

Table 2 shows mean serum calcium level in postmenopausal women was 8.47 $\pm$ 0.83 mg/dl whereas in premenopausal women it was 9.68 $\pm$ 1.94 mg/dl. This difference was found to be statistically significant (p<0.05). However, in case of serum phosphate level, postmenopausal women showed a mean value of 3.82 $\pm$ 2.62mg/dl and premenopausal women had mean level of 3.78 $\pm$ 1.57 mg/ dl. Both these values were not significantly different (P >0.05). Serum ALP levels were higher (P <0.001) in the postmenopausal group (87.36 $\pm$ 18.02) when compared to premenopausal group (68.27 $\pm$ 8.12).

## DISCUSSION

Menopause is the most common cause of osteoporosis because of the effects of estrogen deficiency, which increases the rate of bone remodelling with high turnover resulting in bone loss.<sup>[5]</sup> Bone turnover leading to poor health consequence is increasingly common in both developing and developed world.<sup>[6,7,8]</sup> We estimated serum calcium, phosphorus and serum alkaline phosphatase, as they can be used as indicator of increased bone turnover, to enable early intervention of osteoporosis and to minimize secondary consequences such as fractures due to osteoporotic changes.

In the present study the body mass index (BMI) of postmenopausal women was significantly higher (p<0.05) than premenopausal women. The results are in accordance with other studies.<sup>[9, 10]</sup> BMI generally increases over the course of menopausal transition for all women but the effect is small relative to other influences. According to Shakoor et al (2014)<sup>[11]</sup>, the body mass index has non-significant association with age and osteoporosis.

Serum calcium level was found to be significantly decreased in postmenopausal women (P <0.05), when compared to premenopausal women. There is no consistency in the results as different studies have different outcome regarding serum calcium levels. Some studies found no significant difference in calcium level before and after menopause.<sup>[12]</sup> Whereas many studies reported increased level of serum calcium in postmenopausal women.<sup>[13, 14, 15]</sup> Our findings are in agreement with the studies reported in the literature.<sup>[1, 2, 16]</sup> Calcium supplementation has shown effectiveness for preventing osteoporotic features in postmenopausal women. A meta-analysis has shown the effectiveness of calcium supplementation for the prevention of osteoporotic fractures in postmenopausal women. It revealed 25% to 70% reduction in osteoporotic fractures.<sup>[17]</sup> Intestinal calcium absorption decreases with aging in postmenopausal women resulting in decreased serum calcium level.<sup>[18]</sup> Calcium deficiency may be due to decline in either the active calcium transport or diffusion component of the calcium absorption system.<sup>[19]</sup>

In the present study serum phosphorus level in postmenopausal women was raised slightly than premenopausal women, but the difference was not significant ( $P > 0.05$ ). These findings are in contrast to the finding of ELmalik *et al* 2016<sup>[15]</sup>, Prabha *et al* 2015<sup>[2]</sup>, and Shakoor *et al* 2014<sup>[11]</sup> who found a significantly raised level of serum Phosphorus in postmenopausal women than premenopausal women.

Serum alkaline phosphatase (ALP) activity is the most commonly used marker of bone formation. In the present study, serum ALP levels were significantly higher in postmenopausal women than premenopausal women. Our results are similar to various other studies.<sup>[2, 16, 20, and 21]</sup> The increase in ALP levels may be a result of hormonal changes in postmenopausal women and also due to effect of parathyroid hormone on bone. Alkaline phosphatase (ALP) is the earliest bone marker in postmenopausal women as it plays an important role in bone formation and resorption.<sup>[2]</sup> Elevated levels of serum alkaline phosphatase activity indicate increased activity of the osteoblasts.<sup>[22]</sup> At menopause, the rate of bone remodelling increases. This fact may be explained by the evidence, derived primarily from studies in mice, that loss of sex steroids upregulates the formation of osteoclasts and osteoblasts in the marrow by upregulating the production and action of cytokines that are responsible for osteoclastogenesis and osteoblastogenesis.<sup>[23]</sup>

Since biochemical markers are able to estimate the rate of bone formation and resorption and also provide unique information about rapid bone loss, combined use of biochemical markers and BMI screening may provide a better prediction of osteoporosis. Result of our study show that rate of postmenopausal osteoporosis is quite high in this area, although the number of cases taken in the present study is quite low for reaching any conclusion. To further confirm the findings, another study involving large number of patients with some more biochemical parameters should be planned.

Incidence of postmenopausal osteoporosis and fractures can be reduced by maintaining a balanced diet to achieve adequate calcium and vit D intake. It is also necessary to avoid smoking and high intake of alcohol alongwith regular weight bearing exercise.

## CONCLUSION

Osteoporosis is a complication of menopause mainly due to imbalance in hormonal factors like estrogen, prolactin and changes in bone formation markers like calcium, phosphorus and alkaline phosphatase. We found a high rate of osteoporosis in postmenopausal women of this region however; another study with greater no. of cases is needed.

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