# Study of Biochemical Bone Bio Markers in Postmenopausal Women in PMCH Dhanbad, Jharkhand

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***Abstract:*** *Aim of this study is to estimate the Serum Alkaline Phosphatase (ALP), Total Calcium, Urinary hydroxyproline and to evaluate the correlation of Age, Body Mass Index (BMI), in postmenopausal women and premenopausal women on these parameters. Serum calcium, BMI, alkaline phosphatase activities were determined in 50 premenopausal and 50 postmenopausal women in PMCH Dhanbad, Jharkhand. The mean Age, BMI, serum total ALP were significantly increased higherand calcium levels were significantly lowerin postmenopausal women when compared to premenopausal women. Bone resorption marker, urinary hydroxyproline was significantly increased in cases.*

*This study concluded that, Serum total ALP, total calcium and Urinary hydroxyproline combined togetherprovided fairly useful index of bone resorption in postmenopausal women. Preventivemeasures like calcium supplementation or Hormone replacement therapy can be initiated early in those who are rapid bone losers and prevent the osteoporotic fractures.*

***Keywords:*** *Alkaline Phosphatase, Calcium, UrinaryHydroxyproline*

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## I. Introduction

Bone loss result when the balance between formation and resorption is not maintained and resorption is excessive resulting in a negative remodelling balance. Number of osteoporotic patients in India is gradually increasing now daysand affect at age 50-60 years which is 10-20 years earlier compare to western country.Bone turnover is a dynamic process which increases in postmenopausal period due todeficiency of oestrogen. Bone turnover can be assessed by measuring the enzymatic activity related to the bone forming or reabsorbing cells. Dual Emission X-ray Absorptiometry (DEXA) for estimating Bone Mineral Density (BMD) is not yet easily available in developing country like India and changes are also late and irreversible. Biochemical markers are able to estimate the rate of bone formation and resorption and also provideinformation regarding rapid bone loss.

For better prediction of osteoporosis combined use of biochemical markers and BMD screeningmay be used than BMD measurements alone.Bone markers are usually classified as markers of bone formation –serum total alkaline phosphatase(ALP), osteocalcin, alkaline phosphatase (ALP) and procollagen type-1 extensionpeptides and markers of bone resorption are urinary hydroxylysine glycosides, hydroxyproline, plasmatartrate resistant acid phosphatase (TRAP) and collagen pyridinium cross-links.

Thisstudy was taken up to measure the levels of serum alkaline phosphatase, calcium and urinaryhydroxyproline to creatinine ratio in post-menopausal women and to compare these parameters with thepre-menopausal women.

## II. MATERIALS AND METHODS

This study was done from April 2016 to April 2017, at Patliputra Medical College& Hospital Dhanbad, Jharkhand, India. Informedconsent was taken by all participants. Study included both premenopausal (30-40 years) and postmenopausal (45-70 years) women. Study consists of 100 healthy women (50 healthy women of reproductive age group with regular menstruation, non-pregnant and not taking oral contraceptive pills were considered as controls and 50 postmenopausal healthy women with history of cessation of menstruation 3-5 years earlier and not on Hormone Replacement Therapy and calcium supplements) .The height and weight of subjects were measured to calculate the Body Mass Index (BMI).

5ml of blood sample and random urine sample was collected aseptically. Serum calcium, estimated using colorimetric methods, while alkaline phosphatase activities were determined using enzymatic methods.

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Concentration of hydroxyproline and creatinine in urine samples were estimated within 24 hours ofcollection of urine. Urinary hydroxyproline wasestimated by spectrophotometric method using the Modified Neumann and Logan method at 540 nm.

## III. Results

The mean age & BMI are higher in postmenopausal women when compared to those of premenopausal women. The mean serum calcium was significantly lower in postmenopausal women compared to premenopausal women. Serum alkaline phosphatase was higher in postmenopausal women when compared to those of premenopausal women.

**Table 1**: Mean age, body mass index (BMI), Serum calcium, Serum alkaline phosphatase, Urinary Hydroxyproline /24 hour in premenopausal and postmenopausal women:

| Characteristics | Premenopausal(n=50) | Postmenopausal(n=50) |
|---|---|---|
| Age(in years) | 32.5±6.8 | 51.8±7.2 |
| Height(in cm) | 149±4.4 | 148±5.1 |
| Weight(in kg) | 52.3±5.2 | 49.8±4.3 |
| BMI(kg/m$^2$) | 24.1±2.3 | 24.8±3.9 |
| Serum calcium(mg/dl) | 8.5±1.2 | 7.8±1.2 |
| Serum alkaline phosphatase(U/I) | 33.5±34.8 | 53.7±32.3 |
| Urinary Hydroxyproline /24 hour | 19. ±2.8 | 31.56±3.8 |

## IV. Discussion

Results of the present study show that the increase in serum ALP levels and urinary hydroxyproline levels in postmenopausal women were highly significant when compared with premenopausal women and also the serum calcium levels were decreased in postmenopausal women than in premenopausal controls and were statistically significant, these findings were in accordance with several studies (Sachdeva*et al.,* 2005; Mitoma*et al.,* 1959; Garnero*etal.,* 1996; Indumati*et al.,* 2007; Agrawal*et al.,* 2009; Suresh and Naidu, 2006).

The prevalence ofosteoporosis increases with age. Bone mass decreases with aging, and it is major determinant of all osteoporotic fractures(Iuaska*et al.,* 2007).

Measurement of Bone Mineral Density (BMD) with other risk factors can potentially improve theidentification of osteopenic women with high risk of developing osteoporosis. Bone metabolism can be assessed by measuring bone turnover markers in serum or urine (Iuaska*et al.,* 2007). The main aim of the study was to estimate, Total Alkaline phosphatase (ALP), Total calcium and urinary Hydroxyproline in postmenopausal women and premenopausal controls and to find out whether the measurement of the above parameters could be useful in assessing the increased bone turnover in postmenopausal women.

A total number of 100 subjects were studied comprising of 50 premenopausal women as controls and 50 postmenopausal women as cases.

**Serum Alkaline phosphatase (ALP)**

Our results show that the increase in serum ALP levels were highly significant ($p < 0.001$) in postmenopausal women when compared to premenopausal controls. These findings are in accordance with several studies (Sachdeva*et al.,* 2005; Indumati*et al.,* 2007; Agrawal*et al.,* 2009; Suresh and Naidu, 2006). Elevated blood levels of serum alkaline phosphatase activity indicate increased activity of the osteoblasts.

**Hydroxyproline:**

The urinary excretion of hydroxyproline is increased in states of physiologically high turnover, such as somatic growth, during menopause and high turnover osteopathies (Auth*et al.,* 2008).
Our results show that urinary hydroxyproline was increased in postmenopausalwomen compared to premenopausal controls. These findings were in accordance with other studies Agrawal*et al.,* 2009. Thus simple, direct urinary assay of hydroxyproline to measure bone resorption have clinical applications as part of screening programs to assess the risk of osteoporotic fractures.

**Serum total calcium:**

Our results showed that the level of serum total calcium was decreased in postmenopausal womencompared to premenopausal controls and was statistically significant ($p < 0.05$). These findings were in accordance with the studies of other investigators (Indumati*et al.,* 2007; Riggs *et al.,* 1969).

It also suggests that simple, easy, common biochemical markers such as urinary hydroxyproline, total serum ALP, and total serum calcium could be used as indicators of increased bone turnover, to enable early intervention so as to minimize fractures due to osteoporosis.

Combined biochemical and BMD screening may provide better prediction of future fracture risk than BMD alone. The purpose of the study was to estimate the biochemical markers of bone formation (Serum Total ALP and Total Calcium) and bone resorption (Urinary hydroxyproline) in postmenopausal women. Another limitation is that the serum total ALP used as a marker of bone formation is not bone-specific but as the other causes of rise in total ALP have been ruled out in the participants during the study, the rise in total ALP is mainly due to the bone isoenzyme.

However, we suggest that the bone specific alkaline phosphatase is more specific marker of bone formation than total ALP.

## V. Conclusion

Early detection of bone loss by measurement of Bone Mineral Density (BMD) helps to confirm the diagnosis of osteoporosis and assesses the future risk of osteoporotic fractures so that timely therapy can be instituted. Dual X-ray Absorptiometry (DXA) is the gold standard to assess BMD but is not easily available in developing country like India especially in our region.

Bone turnover assessed by bone biopsies is the most reliable method available at present.

Biochemical markers of bone turnover have been shown to provide valuable information for the diagnosis and monitoring of metabolic bone disease like postmenopausal osteoporosis. They reflect the whole body rates of bone resorption and bone formation.

The results of the current study support the concept that the common biochemical parameters of bone turnover can identify postmenopausal women who are at an increased risk of developing osteoporotic fractures. The high turnover bone loss which occurs in postmenopausal women is due to the oestrogen deficiency at the menopause which increases the rate of bone remodelling. Monitoring bone status using biochemical parameters could serve as a screening measure in early intervention for excessive bone loss.

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