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## SERUM CALCIUM, INORGANIC PHOSPHORUS AND URIC ACID LEVELS DURING VARIOUS PHASES OF MENSTRUAL CYCLE

M. A. Lanje\*, A. K. Bhutey, S. R. Kulkarni, U. P. Dhawle and A. S. Sande

Department of Biochemistry, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra, India

### ABSTRACT

Hormonal changes during the menstrual cycle are well documented but there are very few reports on the changes in serum calcium, phosphorus and uric acid levels in various phases of the menstrual cycle. Therefore, present study was conducted on 50 healthy females in the age group of 18-35 menstruating regularly (cycle length between 25 and 35 days). The study demonstrated that serum calcium levels were significantly ( $p < 0.001$ ) higher in follicular phase than menstrual and luteal phases. Serum inorganic phosphorus levels decreased progressively and significantly ( $p < 0.001$ ) from the menstrual phase to the follicular phase and from the follicular phase to the luteal phase while serum uric acid levels were significantly ( $p < 0.001$ ) lower in luteal phase than the menstrual and follicular phases. These changes in calcium, phosphorus and uric acid in serum may have significance in terms of the normal reference interval, hence necessitate small but significant alterations to the normal reference interval for these analytes in menstruating women.

#### Keywords:

Calcium,  
Inorganic phosphorus,  
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#### Correspondence to Author:

Dr. Milind A. Lanje

C2/S3, Shivarangan Towers,  
Someshwar wadi, Pashan, Pune,  
Maharashtra, India

**INTRODUCTION:** The cyclic hormonal changes can affect a variety of physiological and biochemical processes, however, changes in other biochemical variables have not been studied. Hormonal changes during the menstrual cycle are well documented<sup>1-3</sup>, but there are very few reports on the changes in serum calcium, phosphorus and uric acid levels in various phases of the menstrual cycle in otherwise healthy women.

It has, however, been reported that estrogen induces hypercalcemia through the action of the parathyroid gland<sup>4</sup>. Withdrawal of estrogen is reported to cause a significant loss of bone calcium<sup>5</sup>. It has also been found that the phosphate concentration falls more rapidly than the calcium rise after parathyroid hormone administration<sup>4</sup>. This decline in phosphate concentration is caused by a strong effect of parathyroid hormone on the kidney, causing renal phosphate excretion<sup>6</sup>. Dullo P and VEDI N have reported that serum calcium level was highest in the follicular phase whereas the serum inorganic phosphorus level was highest in the menstrual phase<sup>7</sup>.

After the menopause the concentration of uric acid in plasma increases. This is believed to be the result from decrease in sex-steroid concentration, similar to that which occurs at the time of onset of menstruation<sup>8</sup>. It is possible that changes in hormone concentrations during the menstrual cycle may influence the concentrations in plasma of commonly measured analytes. Hence, our aim was to assess the changes in the levels of serum calcium, inorganic phosphorus and uric acid during the different phases of the menstrual cycle in young healthy women.

**MATERIALS AND METHODS:** The study was conducted on 50 healthy females in the age group of 18-35 menstruating regularly (cycle length between 25 and 35 days). Subjects using hormonal

methods of contraception, having a history of any significant past illness or recent acute illness affecting the menstrual cycle and subjects taking any medication (including dietary supplements such as vitamins) for at least a month before the study were excluded.

The clinical history of the subjects was noted and different phases of the menstrual cycle (menstrual, follicular and luteal phases) were determined by a detailed menstrual history. 5 ml Blood was drawn within the first two days of the cycle during the menstrual phase, within the eighth to fourteenth days during the follicular phase and after the 22<sup>nd</sup> day during the luteal phase until the next cycle began. Each sample was analyzed for levels of serum calcium, serum inorganic phosphorus and serum uric acid on Selectra-E random access clinical chemistry analyzer.

Statistical analysis of the three sets of data (menstrual, follicular and luteal phases) for each analysis was carried out by ANOVA Test.

## RESULTS:

**TABLE 1: SERUM CALCIUM, INORGANIC PHOSPHORUS AND URIC ACID (mg/dl) LEVELS IN THE VARIOUS PHASES OF THE MENSTRUAL CYCLE IN HEALTHY WOMEN**

| Phases of Menstrual cycle | Mean $\pm$ SD (mg/dL) |                            |                    |
|---------------------------|-----------------------|----------------------------|--------------------|
|                           | Serum calcium         | Serum inorganic phosphorus | Serum Uric acid    |
| Menstrual phase           | 9.50 $\pm$ 0.43       | 4.11 $\pm$ 0.26**          | 5.18 $\pm$ 0.5     |
| Follicular phase          | 9.74 $\pm$ 0.43*      | 3.78 $\pm$ 0.27            | 4.81 $\pm$ 0.69    |
| Luteal phase              | 9.28 $\pm$ 0.41       | 3.48 $\pm$ 0.35            | 4.35 $\pm$ 0.72*** |

n = 50; \*Significantly higher as compared to the other two ( $p < 0.01$ ); \*\*Significantly higher as compared to the other two ( $p < 0.01$ ); \*\*\*Significantly lower as compared to the other two ( $p < 0.01$ )

**Table 1** shows our results that the serum calcium levels were significantly higher in follicular phase ( $9.74 \pm 0.43$ ) than menstrual ( $9.50 \pm 0.43$ ) and luteal ( $9.28 \pm 0.41$ ) phases. Serum inorganic phosphorus levels decreased progressively and significantly from the menstrual phase ( $4.11 \pm 0.26$ ) to the follicular phase ( $3.78 \pm 0.27$ ) and from the follicular phase to the luteal phase ( $3.48 \pm 0.35$ ). Serum uric acid levels were significantly lower in luteal phase ( $4.35 \pm 0.72$ ) than the menstrual ( $5.18 \pm 0.5$ ) and follicular ( $4.81 \pm 0.69$ ) phases.

However, none of all the above values were outside the normal range.

**DISCUSSION:** An extensive literature search has revealed very scanty data for the changes in serum calcium, inorganic phosphorus and uric acid levels in the various phases of the menstrual cycle.

Our result of significantly higher calcium levels during the follicular phase than other two phases correlates well with earlier research which shows that the increase in serum calcium levels during the follicular and ovulatory phases could be due to the effect of estrogen on the parathyroid glands<sup>7, 9</sup>. Reportedly, the higher levels of progesterone compared to estrogen during the luteal phase could be responsible for these low serum calcium levels<sup>10</sup>.

The present study also compares well with an earlier observation that high estrogen production can lead to a decrease in serum inorganic phosphorus levels<sup>11</sup>. The change in uric acid concentration in present study parallels that seen after menopause. During the luteal phase the concentration of ovarian steroids in the circulation is high and the uric acid concentration is low, whereas in the follicular phase the reverse is true<sup>12, 13</sup>. These changes in calcium, phosphorus and uric acid in plasma may have significance in terms of the normal reference interval, hence necessitate

small but significant alterations to the normal reference interval for these analytes in menstruating women.

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