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Measurement of Serum Calcium, Magnesium and Phosphorus Level during Different Phases of Menstrual Cycle

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Abstract: ***Introduction:*** *The menstrual cycle is the regular natural change that occurs in the uterus and ovaries that make pregnancy possible. The cycle is required for the production of ovocytes, and for the preparation of the uterus for pregnancy. Up to 80% of women report having some symptoms during the one to two weeks prior to menstruation. Common symptoms include acne, tender breasts, bloating, feeling tired, irritability, and mood changes.*
Aims and objectives: *The purpose of this study was to evaluate the changes in serum Calcium, Magnesium and Phosphorus levels during various phases of menstrual cycle in healthy normally menstruating female.*
Materials and methods: *The 90 healthy female volunteer students participated as subjects in this study. The blood sample was collected three times from each subject during their menstrual, proliferative and secretory phase. Estimation of serum calcium, magnesium and phosphorus was carried out on the same day of collection of blood sample.*
Results: *Highest level of serum calcium was seen in proliferative phase. Highest level of serum magnesium was seen in secretory phase. Study showed gradual decrease in serum phosphorus level from menstrual to proliferative phase and also from proliferative to secretory phase. Highest level of serum phosphorus was seen in menstrual phase.*
Conclusions: *These variations could be due to the impact of the changing estrogen and progesterone secretion on the parathyroid glands.*
Keywords: *Serum, Calcium, Magnesium, Phosphorus, Menstrual cycle.*

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I. Introduction

The menstrual cycle is unique to female human beings and a few nonhuman primates. It results from a complex interaction between the hypothalamus, the anterior pituitary gland, the ovaries and the uterus. Hormonal changes during this cyclic process result in the ovulation of a mature oocyte from the ovary into the endometrium which is favorable for the implantation of the fertilized ovum. [1]

The average menstrual cycle of 28 days (23-29 days) is divided into three phases.[2] The first phase, an estrogen dominated phase, lasts up to the time of ovulation, during which there is an increase of 1ñ5 mm in the endometrium. This phase is known as the proliferative phase or the follicular phase.[3] The second phase, the secretory or luteal phase, is due to an increase in progesterone secretion causing a coiling of the endometrial vessels and a thickening of the endometrium. In the last phase, the menstrual phase, there is a decrease in all the ovarian hormones which, in turn, decreases the production of all anterior pituitary reproductive hormones. This results in the shedding off of the superficial part of the endometrium due to a vasospasm produced possibly by locally released prostaglandins.[4-6]

II. Materials and Methods

This prospective study was conducted at Kurnool Medical College, Kurnool in 2018.The study involved 150 healthy female volunteers. The subjects were selected on the basis of normal and regular menstrual cycle i.e. (28+4) cycle. Those students having irregular menstrual cycle, distressing symptoms like severe abdominal pain, heavy or scanty menstrual blood loss are excluded from the study.

Determination of different phases of menstrual cycle

The regular menstrual cycle of 28 days can be divided in to three phases as per the day of menstrual cycle as follow.

Menstrual phase from 1^{st} to 5^{th} day,
Proliferative phase from 6^{th} to 14^{th} day

Secretory phase from 15th to 28th day

Collection of blood sample

The blood sample was collected three times from each subject during their menstrual, proliferative and secretory phase. The blood sample was drawn in the morning hours between 8.00 am to 9.00 am during each phase of menstrual cycle. About 3 ml of blood sample was drawn from the anticubital vein collected in plane bulb; blood sample was taken on 2nd, 10th and 22nd days of menstrual cycle. Serum gets separated after centrifugation of blood sample in REMI centrifuge at 3000 RPM and used for estimation of following biochemical parameters.

- Serum Calcium
- Serum Magnesium
- Serum Phosphorus

Serum calcium was estimated by Modified Arsenazo method, Phosphorus was estimated by Ammonium Molybdate method and magnesium was estimated by Xylidyl blue method in ERBA CHEM PLUS V2 semi automated biochemistry analyzer along with Quality control data.

For the levels of serum calcium, magnesium and phosphorus mean and standard deviations (S.D.) were calculated during menstrual, proliferative and secretory phase. Then find out the difference, the comparison was made for each parameter between menstrual and proliferative phase, between proliferative and secretory phase and between menstrual and secretory phase. The significance of the difference was tested by student t-test by using online student t-test calculator. P-value less than 0.05 was considered as a difference of significance.

III. Results

Menstrual cycle phase	Serum calcium levels (mg/dl)
Menstrual phase	9.65±0.54
Proliferative phase	9.86±0.65
Secretary phase	8.70±0.70

Table 1: Mean levels of serum calcium (mg/dl) during different phases of menstruation

Menstrual cycle phase	Changes	P value
Menstrual Vs Proliferative	Increase	<0.05 (Significant)
Proliferative Vs Secretary phase	Decrease	<0.05 (Significant)
Secretary phase Vs Menstrual	Decrease	<0.05 (Significant)

Table 2: Statistical analysis of serum calcium levels during different phases of menstrual cycle.

Menstrual cycle phase	Serum Phosphorus (mg/dl)
Menstrual phase	4.67±0.43
Proliferative phase	3.54±0.32
Secretary phase	2.90±0.45

Table 3: Mean levels of serum Phosphorus levels during different phases of menstrual cycle.

Menstrual cycle phase	Changes	P value
Menstrual Vs Proliferative	Decrease	<0.05 (Significant)
Proliferative Vs Secretary phase	Decrease	<0.05 (Significant)
Secretary phase Vs Menstrual	Decrease	<0.05 (Significant)

Table 4: Statistical analysis of serum Phosphorus levels during different phases of menstrual cycle.

Menstrual cycle phase	Serum magnesium (mg/dl)
Menstrual phase	1.87±0.45
Proliferative phase	1.65±0.32
Secretary phase	2.45±0.35

Table 5: Mean levels of serum magnesium levels during different phases of menstrual cycle.

Menstrual cycle phase	Changes	P value
Menstrual Vs Proliferative	Decrease	<0.05 (Significant)
Proliferative Vs Secretary phase	Increase	<0.05 (Significant)
Secretary phase Vs Menstrual	Increase	<0.05 (Significant)

Table 6: Statistical analysis of serum magnesium levels during different phases of menstrual cycle.

IV. Discussion

The menstrual cycle is the most extensively studied rhythm in women. The hormonal changes during the normal menstrual cycle are well established and these hormonal changes are commonly associated with fluctuations in the state of physiological functions and subjective feeling in women. An extensive literature search has revealed very scanty data for the changes in serum calcium, magnesium and inorganic phosphorus levels in the various phases of the menstrual cycle. Changes in these ions are, however, reported to be mainly due to changes in the hormonal levels during the different phases of the menstrual cycle.[8-10]

In the present study, the mean serum calcium levels increased by 5.61% in the follicular phase as compared to the menstrual phase and decreased by 7.86% in the luteal phase. Earlier research 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. Reportedly, the higher levels of progesterone compared to estrogen during the luteal phase could be responsible for these low serum calcium levels. Our results are in agreement with these reports.

Increased serum calcium levels during the proliferative phase may also contribute to the decreased magnesium levels by exerting an effect on the cell permeability [9]. The study showed the serum phosphorus level decreased in the proliferative and secretory phases as compared to the menstrual phase. This pattern is consistent with an earlier report in which serum phosphorus levels were found to be higher during the menstrual phase than in the other two phases. The present study also compares well with an earlier observation that high estrogen production can lead to a decrease in serum inorganic phosphorus levels [10].

V. Conclusion

From my study conclusion is that gradual increase in serum calcium level from menstrual to proliferative phase and gradual decrease from proliferative to secretory phase. Highest level of serum calcium was seen in proliferative phase. It further showed gradual decrease in serum magnesium level from menstrual to proliferative phase and then gradual increase from proliferative to secretory phase. Highest level of serum magnesium was seen in secretory phase. Highest level of serum phosphorus was seen in menstrual phase.

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