

Serum Calcium and Magnesium Levels During Different Phases of Menstrual Cycle

*Khondoker F,¹ Rahman MA,² Mosawuir MA,³ Akhter L⁴

The cyclical hormonal changes that occur during various phases of menstrual cycle, may affect physiological and biochemical processes affecting various minerals like calcium, magnesium in the body. This study was done to evaluate the changes in serum calcium, magnesium levels during various phases of menstrual cycle in healthy normally menstruating females. This cross sectional study was carried out in the Department of Biochemistry, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka from July 2014 to June 2015. Here we evaluated 35 healthy female students in the age group of 18 to 24 years with normal menstrual cycle at an interval of 27-33 days. Serum calcium & magnesium were estimated during menstrual, proliferative and secretory phases of menstrual cycle using standard procedures that is Bichromatic end point method. The significance of the difference was tested by paired 't' test. Statistical significance was set at $p < 0.05$. Highest level of serum calcium was seen in proliferative phase but highest level of serum magnesium was seen in secretory phase. Changes in serum calcium & magnesium were noted during different phases of menstrual cycle. It may be due to the influence of ovarian hormones.

[Dinajpur Med Col J 2017 Jan; 10 (1):112-115]

Key words: Calcium, magnesium, menstrual cycle

Introduction

The menstrual cycle is a complex process involving the interaction of the hypothalamus, the anterior pituitary, the ovaries and the uterus. The hormonal changes occurring during this cyclic process not only affect oocyte maturation and the endometrial and vaginal environments but can also have an effect on a number of other physiological and biochemical phenomena. The menstrual cycle is influenced by FSH, LH, estrogen and progesterone hormones. These hormones affect oxygen carrying

capacity, immune response, bleeding tendency and changes in serum electrolytes which may be responsible for variable physical, psychological symptoms and autonomic changes.¹ Effect of ovarian hormones on water and electrolyte balance is well documented and has been published earlier by the author. Estrogen leads to a marked acceleration of calcium uptake. In non-pregnant women estrogen administration produces increased parathyroid activity. It is known that the calcium homeostasis is

1. *Dr. Farzana Khondoker, Assistant Professor and Head, Department of Physiology, Rangpur Army Medical College, Rangpur. fkhondoker102@gmail.com
2. Dr. Md. Anisur Rahman, Jr. Consultant (Ortho-surgery), Upazilla Health Complex, Parbotipur, Dinajpur.
3. Dr. Md. Abdullahil Mosawuir. Associate Professor, Department of Physiology, Rangpur Medical College, Rangpur, Bangladesh. dr.rumman@yahoo.com
4. Dr Latifa Akhter, Assistant Professor (Skin & VD), Rangpur Medical College Hospital, Rangpur, Bangladesh.

*For correspondence

maintained by parathyroid glands. However, effect of menstrual cycle on serum calcium remains controversial. It is also reviewed that published literature does not assign specific role to magnesium in regulation of menstrual function, although magnesium is involved in basal metabolism that changed over the course of menstrual cycle. These evidences suggest possibly ovarian hormones influence Ca and Mg metabolism during the different phases of menstrual cycle.³ 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 phosphorus levels in the various phases of menstrual cycle.⁴

Methods

This cross sectional study was carried out in the Department of Biochemistry, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka from July 2014 to June 2015. The study protocol was approved by the Ethical Committee. About 35 healthy female volunteers participated as subjects in this study. Each subject has been explained about the procedure of the test to eliminate fear and apprehension. Informed written consent was taken from each subject. The subjects were selected on the basis of normal and regular menstrual cycle. 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. A thorough clinical check-up was done to exclude subjects suffering from neuropsychiatric disorders or any other illness affecting the menstrual cycle. Those volunteers having irregular menstrual cycle,

distressing symptoms like severe abdominal pain, heavy or scanty menstrual blood loss are excluded from the study.

Five milliliters of venous blood were drawn between 8 a.m. and 9 a.m. during each phase of the menstrual cycle. Blood was drawn within the first two days of the cycle during the menstrual phase, within the eighth to fourteenth day during the follicular phase and after the 22nd day during the luteal phase until the next cycle began. For each parameter i.e. for the levels of serum calcium, magnesium, mean and standard deviations (SD) were calculated during menstrual, proliferative and secretory phase. Then to 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 paired 't' test. Statistical significance was set at $p < 0.05$.

Results

In the present study the mean serum calcium levels increased in the proliferative phase as compared to the menstrual phase and decreased in the secretory phase.

Table I: Levels of serum calcium during different phases of menstrual cycle

Phases of menstrual cycle	Levels of Serum Calcium (mg/dl).	
	Mean	SD
Menstrual Phase	9.0714	0.123
Proliferative Phase	10.103	0.522
Secretory Phase	8.766	0.222

The Mean \pm SD serum calcium levels were 9.0714 ± 0.123 mg/dl in menstrual phase.

The Mean \pm SD serum calcium levels were 10.103 ± 0.522 mg/dl in proliferative phase.

The Mean \pm SD serum calcium levels were 8.766 ± 0.222 mg/dl in secretory phase.

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

Phases of menstrual cycle compared	Change observed	p	Remark
Menstrual to Proliferative Phase	Increased	<0.0001	Highly significant
Proliferative to Secretory Phase	Decreased	<0.0001	Highly significant
Menstrual to Secretory Phase	Decreased	<0.0001	Highly significant

Table II showed gradual increase in serum calcium level from menstrual to proliferative phase and then gradual decrease from proliferative to secretory phase.

Table III: Levels of serum magnesium during different phases of menstrual cycle

Phases of menstrual cycle	Levels of serum calcium (mg/dl).	
	Mean	SD
Menstrual Phase	1.68	0.072
Proliferative Phase	1.497	0.106
Secretory Phase	2.28	0.089

The Mean \pm SD serum magnesium levels were 1.68 ± 0.072 mg/dl in menstrual phase.

The Mean \pm SD serum magnesium levels were 1.497 ± 0.106 mg/dl in proliferative phase. The Mean \pm SD serum magnesium levels were 2.28 ± 0.089 mg/dl in secretory phase.

Table IV: Statistical analysis of Serum Magnesium levels during different phases of menstrual cycle

Phases of menstrual cycle compared	Change observed	p	Remark
Menstrual to Proliferative Phase	Decreased	<0.001	Highly significant
Proliferative to Secretory Phase	Increased	<0.001	Highly significant
Menstrual to Secretory Phase	Increased	<0.001	Highly significant

Table IV shows gradual decrease in serum magnesium level from menstrual to proliferative phase and then gradual increase from proliferative to secretory phase.

Discussion

In the present study the mean serum calcium levels increased in the proliferative phase as compared to the menstrual phase and decreased in the secretory phase. This finding is similar with those reported by Das B et al,² Pandya A K et al,⁶ and Das.J et al.⁷ Das B et al² reported that higher serum calcium level during proliferative phase could be due to the effect of estrogen on the parathyroid gland. But during the secretory or luteal phase serum calcium levels were low that could be due to higher progesterone as compared to estrogen. Reportedly, the higher levels of progesterone compared to estrogen during the luteal phase could be responsible for these low serum calcium levels⁵. Pandya A K et al⁶ reported that estrogen causes increase in parathyroid activity which leads to marked acceleration of Ca uptake.

Das J et al⁷ reported that increase serum calcium levels during the proliferative phase could be due to the effect of oestrogen on parathyroid glands and the higher levels of progesterone compared to oestrogen. They all reported that estrogen causes increase in parathyroid activity which leads to marked acceleration of Ca uptake.

Our study shows serum magnesium level is maximum during luteal phase, gradually decreases during menstrual and follicular phases and is lowest during ovulatory phase. This finding is similar with those reported by Pandya K et al⁶, Nepalia R⁸, Lanje MA et.al.⁹ Pandya K et al⁶ reported that ovulatory decrease of serum magnesium may be related to preovulatory estrogen peak. It could be related to concurrent leutinising hormone and follicle stimulating hormone peaks. Nepalia

R⁸ reported that serum magnesium levels were significantly highest during the luteal phase and lowest during the follicular phase. The raised estrogen levels possibly by acting through parathyroid hormone could be responsible for depicting the body stores of magnesium by decreasing the reabsorption of magnesium ions by the renal tubules thus resulting in midcycle decline.

Lanje MA et. al⁹ reported that serum magnesium levels were significantly highest during the luteal phase and lowest during the follicular phase. The raised estrogen levels possibly by acting through parathyroid hormone could be responsible for depicting the body stores of magnesium by decreasing the reabsorption of magnesium ions by the renal tubules thus resulting in midcycle decline. It has also been reported that magnesium ions and oxidative enzymes are needed for carbohydrate utilization which increases significantly during the luteal phase. They all reported that ovulatory decrease of serum magnesium may be related to preovulatory estrogen peak. It could be related to concurrent leutinising hormone and follicle stimulating hormone peaks.

Conclusion

These variations could be due to the impact of the changing estrogen and progesterone secretion on the parathyroid glands.

References

1. Malipatil BS and Patil S. Serum Electrolyte Status and Liver Functions in Different Phases of Menstrual Cycle. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2013; 4(2):990.
2. Das B, Chandra M P, Samanta S, Mallick AK, Sowmya MK. Serum inorganic phosphorus, uric acid, calcium, magnesium and sodium status during uterine changes of menstrual cycle. IJBR. 2012; 3(4):209-213.
3. Sembulingam K and Sembulingam P. 2013. Reproductive system. Essentials of Medical Physiology. 6th Ed. Jaypee Brothers Medical Publishers (P) Ltd. 486-487.
4. Wernly M. In Davis ME, Plotz EJ. Obstetrics Ed. Greenhill JP, W.B. Saunders Co., London 1965 pg 244.
5. Puja Dullo and Neeraj Vedi, Changes in serum calcium, magnesium and inorganic phosphorus levels during different phases of the menstrual cycle. J Hum Reprod Sci. 2008 Jul-Dec; 1(2): 77-80.
6. Pandya AK, Chandwani S, Das TK and Pandya KD. Serum Calcium, Magnesium and Inorganic Phosphorous Levels During Various Phases Of Menstrual Cycle. Indian J Physiol Pharmacol 1995; 39(4): 411-414.
7. Das J, Das A, Mandal A K and Das K. Estimation Of Serum Calcium, Magnesium And Phosphorus During Different Phases Of Menstrual Cycle. International Journal of Information Research and Review. 2015;2(1),301-304.
8. Nepalia R. Measurement of serum calcium, magnesium and phosphorus level during different phases of menstrual cycle. IAIM, 2016; 3(4): 53-56.
9. Lanje MA, Bhutey AK, Kulkarni SR, Dhawle UP and Sande AS. Serum Electrolytes During Different Phases Of Menstrual Cycle. International Journal of Pharma Sciences and Research (IJPSR). 2010;1(10):435-437.