SERUM ELECTROLYTES DURING VARIOUS PHASES OF MENSTRUAL CYCLE

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Summary : The corollary follow up study carried presents variation in electrolyte content of serum during menstrual, follicular, ovulatory and luteal phases of menstrual cycle. Variation in sodium, potassium and chloride were found to be parallel with each other. Their level increase significantly from follicular to ovulatory phase and falls significantly during luteal phase. Bicarbonate levels are higher in follicular and luteal phases while they are lower in menstrual and ovulatory phases.

Key words : menstrual cycle, serum sodium, serum potassium, serum chloride, serum bicarbonate

INTRODUCTION

Cyclic changes occur during menstrual cycle in various reproductive organs as well as in other systems of the body. These changes are brought about mainly by ovarian hormones, estrogen and progesterone.

These sex steroids are known to have effects on water and electrolyte balance. Appreciable retention of sodium and water during luteal phase or premenstrual phase was observed by Thorne *et al.* (14). Salt and water retaining effect during luteal phase could be attributed to increased estrogen (1, 2, 13) and not due to progesterone (17).

Changes in serum electrolytes during menstrual cycle have attracted a few workers and hardly any work is reported in India. Therefore, present study was undertaken to find if there is any cyclic change in level of some of the electrolytes during menstrual cycle.

MATERIALS AND METHODS

Fo'low up study of 25 clinically normal subjects between 18 and 25 years of age for serum electrolytes was carried out during menstrual cycle.

Oral temperature under basal conditions was recorded daily before stepping down from bed throughout the menstrual cycle. Fall of body temperature followed by sudden rise of more than 0·5°F during the midcycle was taken as the ovulation day.

Ten milliliters of fasting venous blood was collected in plain bulb during four phases on particular days of the menstrua cycle that is : --

1. Menstrual — Second day of menstrual cycle.
2. Follicular — Eighth day of menstrual cycle.
3. Ovulatory — On the day of ovulation as calculated from the history that is 14 days prior to the expected day of next menstruation and correlated with the body temperature shift.
4. Luteal — Seven days after the ovulation.

Blood was always collected between 8·00 a.m. and 9·00 a.m. to minimize error due to diurnal variation.

Serum separated after coagulation, was analyzed for electrolytes by the following standard methods :

1. Sodium and potassium by Flame Photometry (15).
2. Chloride by Mercuric nitrite titrimetric method (15).
3. Bicarbonate by Volumetric procedure of Van Slyke (15).

RESULTS AND DISCUSSION

From the values in the table and their graphical representation, it is evident that serum concentrations of sodium, potassium and chloride parallel with each other, from a maximum levels of these electrolytes during ovulatory phase. There is a highly significant fall in luteal phase. Insignficant fall from luteal to menstrual and rise from menstrual to follicular phase was also observed. Thereafter the levels rise significantly from follicular to ovulatory phase. (Table I, Fig. 1).

TABLE I : Mean and S.D. values of serum sodium, potassium, chloride and bicarbonate concentration during various phases of menstrual cycle.

Electrolytes in mEq/L.	*Ovulatory phase*	*Luteal phase*	*Menstrual phase*	*Follicular phase*
Sodium	145.52** ±03.16	140.84 ±02.85	139.20 ±03.83	140.88 ±03.57
Potassium	004.59** ±00.37	004.05 ±00.39	003.92 ±00.37	004.09 ±00.42
Chloride	106.32** ±04.60	099.20 ±04.26	100.04 ±04.88	100.36 ±04.61
Bicarbonate	026.88* ±02.27	027.51 ±02.85	026.08 ±02.75	028.76 ±02.35

n = 25 ; ** P<0.001; *P<0.01.

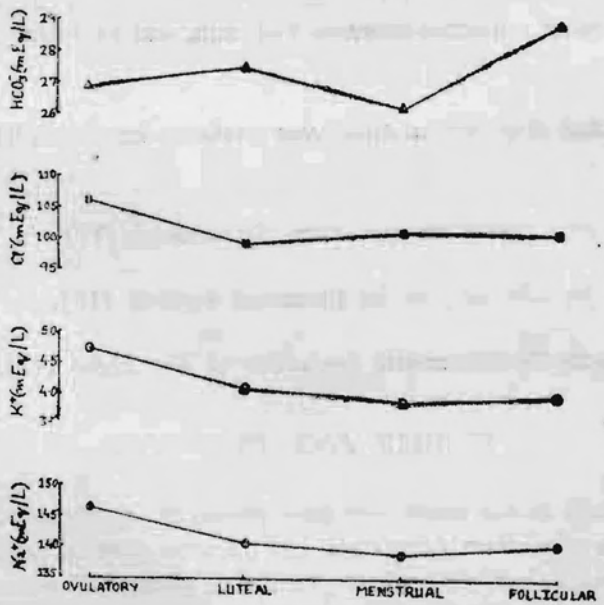

Fig. 1 : Electrolyte concentration in mEq/L. during various phases of menstrual cycle.

Our results are in agreement with those of Overman *et al.* (10) who observed that plasma sodium, potassium and chloride were increasing to peak levels in midcycle and then declining gradua ly till the onset of next menstruation. Eckstein *et al.* (13) studied serum sodium and chloride levels during menstrual cycle and found the peak concentrations at ovulation and low point in premenstrual phase. Philips *et al.* (11) have reported similar changes in serum sodium and potassium levels; wh le chloride levels were found to be lower during menstruation and increase premenstrually.

Frank and Carr (4) have studied serum electrolytes during mensus and intermensus. They found insignificant changes in sodium, potassium and chloride levels, though mean values for serum sodium were slightly lower during mensus compared to intermensus.

Some workers have observed no consistent variation in serum electrolytes during menstrual cycle (7,9,12,16).

Increase in levels of serum sodium, potassium and chloride during fol icular and ovulatory phases could be attributed to increased concentration of estrogen known to occur during this part of the cycle. However, Hasan *et al.* (6) in his study on rats observed decrease in serum levels of sodium and potassium following treatment with estrogen. This difference could be because of species difference and also the effects of high estrogen levels as a result of exogenously administered estrogen may differ from those observed in normal peak estrogen phases during the reproductive cycle.

In luteal phase progesterone secretion is much more than estrogen secretion. This high level of progesterone may be the cause of lowered level in these electrolytes which could be explained as follows : It is believed that progesterone and aldosterone combine with the same receptor proteins in epithelial cells of distal convoluted tubules of kidney. So when progesterone combines with these receptors aldosterone can not, and it is known that progesterone exerts many times less sodium transport effect than does aldosterone. Therefore, despite the fact that under appropriate conditions progesterone can promote sodium and water retention by the renal tubules, it blocks the far more potent effect of aldosterone, thus resulting in net loss of sodium and water from the body (5).

We have observed increase in serum bicarbonate in luteal and follicular phases while in ovulatory and menstrual phases the levels were low. Rise in serum bicarbonate concentrations from menstrual to follicular and fall from follicular to ovulatory phases is statistically significant. While Frank and Carr (4) and Newman (9) found no consistent

changes in serum bicarbonate content during menstrual cycle. It is difficult to explain these contradictory data.

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