Serum Iron Status and Blood Hemoglobin Concentration during different Phases of Menstrual Cycle in Sedentary Females

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ABSTRACT

Objective: To determine the serum iron status and blood hemoglobin concentration during different phases of menstrual cycle in sedentary females.

Material and Methods: Fifty healthy sedentary unmarried females of 22 to 25 years of age were recruited in the present study to determine the changes in serum iron status and blood hemoglobin concentration during different phases of menstrual cycle. Menstrual history was recorded on a questionnaire. Oral temperature, blood hemoglobin and serum iron levels were measured during various phases of the menstrual cycle.

Results: Their average duration of menstrual cycle was 28 to 32 days. Luteal phase had slightly higher value of oral temperature than the follicular and flow phases of menstrual cycle. Significantly ($p < 0.05$) lower values of blood hemoglobin concentration and serum iron level were noted during the flow phase in comparison with follicular and luteal phases. Correlation statistic revealed significant relationship between serum iron level and blood hemoglobin concentration during follicular ($r = 0.602, p < 0.05$), luteal ($r = 0.611, p < 0.05$) and flow ($r = 0.653, P < 0.05$) phases of menstrual cycle.

Conclusion: It can be concluded that, in the studied population oral temperature increases in the luteal and flow phases compared to the follicular phase and the blood hemoglobin concentration was lower in the flow phase in comparison with follicular and luteal phases. However, serum iron level decreased significantly ($P < 0.05$) in the flow phase. *J Med Sci* 2009; 12(1):8-10.

Key words: Hemoglobin, Serum iron, oral temperature, Flow phase, Luteal phase, Follicular phase.

Introduction

Oral temperature is under the control of thermoregulatory centers. During ovulation basal body temperature rises to 0.3°C . Iron is an essential component of hemoglobin, myoglobin and certain enzymes, which are required for oxygen transport and cellular respiration. The blood hemoglobin concentration is significantly correlated with speed of movement, strength and ability to

sustain prolonged moderate muscular effort.¹ It is very interesting that three aspects of physical fitness that is speed, strength and ability to sustain prolonged muscular effort increase with the advancement of age from childhood to reach a maximum in early adult life. Males are faster than females and they have constantly higher blood hemoglobin concentration. Therefore much evidences support that the three aspects of physical fitness together with the blood hemoglobin concentration are intimately related and are possibly based upon some common causal factors.¹

Serum iron concentration is influenced by many pathologic and physiologic states. At the time of menses in females, iron concentration decreases at an amount of 1.00 mg per day.²

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Menstrual cycle, serum iron level and blood hemoglobin concentration have intimate relationship with performance level of athletes. Prolonged exercise accelerates iron metabolism and produce large variation in the parameters related to iron status.³ Iron concentration during follicular and luteal phases decreased significantly following exercise in athletes and non-athletes.⁴ A low serum iron level was noticed in females during their flow phase. Work capacity of female athletes improved after treatment with iron.⁵ However, the athletes are not in a greater risk of anaemia than the sedentary individuals and therefore the term “Sports-Anaemia” is misleading, as it doesn’t describe a specific clinical entity.⁶ Oral treatment with iron in female athletes improved the hemoglobin, serum iron, serum ferritin and transferrin saturation.⁷

Various studies have been conducted to study the blood iron related parameters and their changes during different phases of menstrual cycle in sedentary females as well as in female athletes. Similar studies are lacking in Eastern Indian context. Therefore, the present study was conducted to record the serum iron status and blood hemoglobin concentration during different phases of menstrual cycle in healthy sedentary females of Kolkata, India.

Material & Methods

Study population

Fifty unmarried normal healthy sedentary females of 22 to 25 years of age with similar socio-economic background were selected by random sampling from the postgraduate section of the University of Calcutta. Their menstrual history was noted by putting a questionnaire before them. Their average duration of menstrual cycle was 28–32 days. They were also advised not to take any medication during the study period.

Age of each subject was calculated from the date of birth as recorded in the university. Body height and body mass were measured with standard instrument with an accuracy of ± 0.5 cm in case of body height and ± 0.25 kg in case of body mass. Body surface area (BSA) was calculated by the following formula.⁸

$BSA (m^2) = (\text{body height in cm})^{0.725} \times (\text{body mass in kg})^{0.425} \times 0.007184$

The entire experimental protocol was explained to them to allay their apprehension. Ethical permission and written informed consent from each participant were taken for conducting the study.

Measurement of oral temperature

Oral temperature was noted every morning (during the study period) before washing mouth and taking any food.⁹ The subject herself measured the temperature by keeping an ordinary thermometer under the tongue for

about 2-3 min. In the matter of ascertaining their temperatures, we ensured 100% cooperation from their end.

Determination of blood Hemoglobin concentration (gm%) and serum iron level(mg/dl)

Blood sample was collected aseptically from the antecubital vein. The hemoglobin concentration was measured by cyanomethaemoglobin method by a standard procedure of Drabkin and Austin.¹⁰ Serum iron level was measured by colorimetric method named as bathophenanthroline with depolarization.¹¹

Statistical Analysis

Values were expressed as mean $\pm$ SD. Two tail t-test was performed to test the significant variation between the mean values and Pearson's product moment correlation was computed to test the relationship between two variables. Level of significance was set at $p < 0.05$.

Results

The physical characteristics and the oral temperature recorded during different phases of menstrual cycle were tabulated in Table 1. Luteal phase had slightly higher value of oral temperature than the follicular and flow phases of menstrual cycle. Figure 1 depicted significantly ($p < 0.05$) lower values of blood hemoglobin concentration and serum iron level during the flow phase in comparison with follicular and luteal phases. Significant ($p < 0.05$) correlations were found between serum iron level and hemoglobin concentration during follicular ($r = 0.602$), luteal ($r = 0.611$) and flow ($r = 0.653$) phases of menstrual cycle.

Table-1: Physical characteristics and oral temperature (during different menstrual cycle) in healthy female subjects (n=50)

Age (yrs.) (Yrs)	Body height (cm)	Body mass	BSA (m ²)	Oral temperature (°F)		
				Follicular Phase	Luteal phase	Flow phase
23.26 ± 1.74	153.74 ± 6.22	53.59 ± 8.19	1.498 ± 0.116	98.4 ± 0.853	98.6 ± 0.770	98.6 ± 0.824

Discussion

Although statistically insignificant, luteal phase exhibited slightly higher value of oral temperature than the follicular and flow phases of menstrual cycle. This finding corroborated with the observation of Das *et al.*¹² Progesterone elevates basal body temperature by a direct thermogenic effect on the hypothalamus¹³ which is perhaps the cause of higher value of oral temperature in the luteal phase.

Hemoglobin concentration was significantly ($p < 0.05$) lower in the flow phase. Such finding might be

Figure 1: Hemoglobin concentration and serum iron level in healthy female subjects (n=50) during different phases of menstrual cycle

due to the blood loss during menstruation. The findings on hemoglobin concentration in the present study corroborated with previous studies.^{14,15} However, Chatterjee et al.¹⁶ did not find any significant variation in hemoglobin concentration during different phases of menstrual cycle in non-athlete women.

The mean value of serum iron level was significantly lower in the flow phase in comparison with follicular and luteal phases. Luteal phase iron levels were 7.4% higher than follicular phase levels and 13.8% higher than flow phase levels. It is well known fact that serum iron concentration is influenced by many pathological and physiological states. The menstrual loss of blood brings an iron loss of about 1mg per day.¹ However, other studies indicated that serum ferritin, blood hemoglobin and serum iron status are not influenced by menstrual blood loss that in fact acts as an insignificant factor in this aspect.¹⁷ In the present study, since there was no other cause of blood loss, the decrease in serum iron level and blood hemoglobin concentration was attributed to the menstrual blood loss. Milman et al.¹⁸ found that in case of non-iron supplemented women, serum ferritin level was inversely correlated with duration and intensity of menstrual bleeding. However, the increase in serum iron level and blood hemoglobin concentration during the follicular phase was probably due to the cessation of blood loss.

Conclusions

From the present investigation it can be concluded that, in the studied population:-

- Blood hemoglobin concentration was lower in the flow phase in comparison with follicular and luteal phases; and
- Serum iron level decreased significantly in the flow phase compared to the two other phases of the menstrual cycle.

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