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Original Research Paper

Physiology

ASSESS IMPACT OF MENSTRUATION PHASES ON RED BLOOD CELL COUNT AND BLOOD INDICES IN HEALTHY FEMALES AND CORRELATE IT WITH STRESS SCORE.

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ABSTRACT

Background: Menstruation is defined as "periodic and cyclic shedding of endometrium. A series of utero-ovarian and hormonal events take place over a period of 21-35 days, with a mean of 28 days. Aim of the present study is to assess impact of menstruation phases on red blood cell count and blood indices in healthy females and correlate it with stress score. **Method:** Observational study, a total one hundred thirty five healthy female's age group 18 to 35 years old were included in the study. During each visit blood sample was collected and analyzed using hemocytometer and PSS questionnaire were given to subjects for assess stress score. **Results:** RBCs count and blood indices were statistically significant ($p<0.05$) and observed to be high in PP (4.20 ± 0.45) compared to MP (4.18 ± 0.35) and SP (4.16 ± 0.34). **Conclusion:** red blood cell count and blood indices during the menstrual cycle are highly dependent on the phasic changes in the hormones and found a significant negative correlation (r value = -1.000**) of red blood cell count with stress in menstrual cycle.

KEYWORDS : menstrual cycle; red blood cell count; phases of menstrual cycle; perceived stress scale.

INTRODUCTION

Menstruation is defined as "periodic and cyclic shedding of endometrium accompanied by loss of blood" (Tindall et al)[1]. Hormones act as a key regulatory factor in the menstrual cycle, where their secretion is highly influenced by the negative and positive feedback during the follicular and luteal phases[2]. The ovarian functions are controlled by hormones secreted from hypothalamus, anterior pituitary and ovary. They are GnRH, FSH and LH, and gonadal sex hormones. The major factor determining ovarian function is the pulsatile secretion of GnRH from hypothalamic neuroendocrine cells.[3] The naturally occurring cyclic and rhythmic fluctuations in the levels of hormones like progesterone, oestrogen, luteinizing and follicle stimulating hormones during the menstrual cycle not only affect oocyte maturation, the endometrial and vaginal environment but are also interrelated with multiple changes in the female body both biochemically[4] and physiologically.[5] Physiological there are various disorders associated with menstrual cycle which cause morbidity & mortality.[6] Reproductive-aged women of about 9-14% have blood loss that exceeds 80 ml and prolonged[7] and excessive bleeding may provoke or exacerbate anemia and in a certain percentage of cases, may eventually be life threatening if left untreated, thus there arises a need to estimate Hemoglobin (12.0 to 15.5 grams per deciliter), and Red Blood Cell count (4.2 to 5.4 million cells/mcl).[8] The lack of awareness about the potential importance of reducing menstrual flow when women are anemic and lack of knowledge among women about treatment alternatives is of some concern. The maintenance of different blood corpuscles at normal levels during the menstrual cycle is necessary.

Stress can influence people in every age and situation can result in both physical and physiological health.[9] Stress leads the way in causing changes to the menstrual cycle. When the body is under stress, it releases the hormone cortisol. Cortisol affects multiple areas of the body, including estrogen, and a change in estrogen levels alters menstrual cycle lengths.[10]

A number of earlier studies looked at the relationship between stress and menstrual cycle characteristics. For example, Matteo, et al and Matanoski, et al. each found that self-reported measures of stress correlated with longer menstrual cycles. In contrast, Fenster et al found that women who reported that their jobs were characterized by high stress, but low control over their work environment had a higher risk of short cycles. Sanders et al. menstrual cycle characteristics have not only been shown to be associated with self-reported levels of stress, but also with physiologic measures of stress. Sanders and Bruce found that cortisol levels were highest among women with long menstrual cycles.[11] Aim of the present study to assess impact of menstruation phases on red blood cell count and blood indices in healthy females and correlate it with stress score.

METHODS

The present study was carried out in 135 healthy female between the aged groups of 18-35 years with normal regular menstrual cycle were selected. The duration of the cycle was 28 ± 2 days. Subject with irregular cycles, pregnant female, gynecological disorders like endometriosis, fibroids, anemia, cancer, history of drug intake affecting menstrual cycle or history of chronic disease were excluded from the study. Study protocol was explained to the subjects and written informed consent was obtained from each of the subjects before took blood sample. Institutional ethical committee clearance was obtained. First sample was collected within 48 hours of onset of menstruation, second sample during days 8th-10th of menstrual cycle. Third sample was taken during days 22nd-24th of menstrual cycle. All the subjects were followed up during a single cycle. Samples were taken at morning time at 9am-10am to avoid diurnal variation. Red blood cell count was made under Improved Neubauer's chamber examined under compound microscope using hemocytometer method in the Haematology Laboratory of Department of Physiology, Rajasthan University of Health & Sciences College of Medical Sciences, Jaipur, Rajasthan and questionnaire was distributed to all included subjects to assess their stress score.

Blood Indices calculate by formulas such as

MCV = Pcv per liter of blood / Rbc count in million/mm3,

MCH = Hb conc in gm per 100ml of blood / Rbccount in million per cumm of blood × 100,

MCHC = Hb conc in gm per 100ml blood / Pcv in mlper 100ml blood × 100

Data Analysis

The parameters were statistically analysed by using descriptive statistical i.e., mean and standard deviation. The p value <0.05 was considered statistically significant and Pearson's correlation test were used to correlate red blood cell count and stress score. Data were analyzed by using SPSS 16.0 version.

RESULTS

Table 1.1: Red Blood Cell Count and Blood Indices in Different Phases of Menstrual Cycle.

Hematological Parameters	Menstrual phase Mean ± SD (n= 135)	Proliferative phase Mean ± SD (n= 135)	Secretory phase Mean ± SD (n = 135)
RBCs count (million/μL)	4.18 ± 0.35	4.20 ± 0.45	4.16 ± 0.34
MCV (fL)	85.96 ± 4.31	86.08 ± 4.35	85.96 ± 4.31

MCH (pgm)	28.60 ± 0.36	28.61 ± 0.21	28.60 ± 0.38
MCHC (gm/dl)	33.32 ± 1.55	33.44 ± 2.35	33.32 ± 1.55

The $p<0.05$ was considered as statistically significant.

Table 1.1: depicts that hematological parameters such as red blood cell count (4.20±0.45 million cells/cu mm), mean corpuscular volume (86.08±4.35), mean corpuscular hemoglobin (28.61±0.21) and mean corpuscular hemoglobin concentration (33.44±2.35) were high in proliferative phase. A statistically significant decrease in red blood cell count, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration were observed in secretory phase compared to proliferative phase.

Table 1.2: Correlation between Red Blood Cell Count in Different Menstrual Phases with Stress Score

Hematological Parameters	Menstrual Phase PSS			Proliferative Phase PSS			Secretory Phase PSS		
	Mild	Moderate	Sever	Mild	Moderate	Sever	Mild	Moderate	Sever
RBC count	.415	.084	-1.000**	.0434	.080	-1.000**	.431	.024	-.308

Table 1.2: depicts that a significant negative correlation (r = -1.000**) between red blood cell count and stress in menstrual phase and proliferative phase of menstrual cycle and found not significant in secretory phase.

DISCUSSION

The present observational study was conducted in the hematology laboratory of department of Physiology, RUHS College of medical sciences, Jaipur. The population evaluated under the study was 135 healthy females of age group between 18 to 35 years. In this present study haematological parameters were assessed in different phases of menstruation. Such as red blood cell (RBCs) count and blood indices (MCV, MCH, MCHC) at various phases of menstrual cycle were studied and analysed. In the present study, RBCs count were statistically significant ($p<0.05$) and observed to be high in PP (4.20±0.45) compared to MP (4.18±0.35) and SP (4.16±0.34) which was in accordance with the results of a study by Dapper et al [12] this might be due to the blood loss during MP of the cycle, leading to a reduction in RBC and fluctuation in oestrogen and progesterone levels. Another similar study was done by Hanchinal et al [13] result were reported among all hematological parameters, RBCs count was high in PP that is similar to our study. This study concluded that the hematological parameters during the menstrual cycle are highly dependent on the phasic changes in the immune response mechanism and hormones.[68] This study revealed that the red blood cell indices (MCV, MCH, MCHC) shows a significant decrease in menstruation phase compared to the proliferative phase and secretory phase of the cycle. Similar study conducted by Omorogiuwa et al [14] Red Blood Cell count value for the menstruation and follicular phases were 4.69±0.14 and 4.90±0.15 (106 /μL) respectively ($p<0.05$).

In the present study we were assessed correlation between red blood cell count and stress in different menstrual phases. We found a significant negative correlation (r value = -1.000**) of red blood cell count with stress in menstrual phase and proliferative phase of menstrual cycle. Similar study conducted by Venkappa S. et al [15] results were reported that estrogen is an inhibitor while testosterone is a stimulator of erythropoiesis and psychological stress also decreases the femoral bone marrow iron along with serum iron and erythropoietin. Stress and stress hormones inhibits the release of gonadotropin releasing hormone from the hypothalamus. The stress hormone cortisol (glucocorticoids) inhibits the release of luteinizing hormone from the pituitary and estrogen and progesterone secretion by the ovary. Estrogen act directly on the stem cell to increase the number of red blood cells. Due to stress inhibition of estrogen secretion may effect on erythropoiesis and number of red blood cells count.

CONCLUSION

Menstrual, proliferative and secretory phases of menstrual cycle gives variations of red blood cell count and blood indices may be due to hormonal changes occurring during reproductive age. A statistically significant decrease in red blood cell count, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration were observed in secretory phase compared to proliferative phase and significant negative correlation found between red blood cell count and stress.

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Conflict of interest

None to declare.

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