



Research Article

EVALUATION OF HEMATOLOGICAL AND PULMONARY FUNCTION TEST PARAMETERS IN DIFFERENT PHASES OF MENSTRUAL CYCLE IN RURAL SOUTH INDIAN POPULATIONN Kannan^{1*}, R Aravind Kumar¹, Ramaprabha P¹, P Naveen², Ivvala Anand Shaker³¹Department of Physiology, Melmaruvathur Adhiparasakthi Institute of Medical Sciences, Melmaruvathur-603319 Tamilnadu, India²Department of Physiology, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur-621 212 Tamilnadu, India³Department of Biochemistry, Melmaruvathur Adhiparasakthi Institute of Medical Sciences, Melmaruvathur-603319 Tamilnadu, India

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Abstract: Menstrual cycle is a physiological process that occurs in women. It is characterized by periodic vaginal bleeding due to shedding of uterine mucosa. This has its own effect on various systems and metabolisms. This study was attempted to understand the variations in hematological and respiratory parameters in different phases of menstrual cycle. The present study was conducted on 50 healthy female volunteers within the age group of 18 to 23 years having regular menstrual cycle of 28 ± 3 days from the rural area of Chennai, South India. We analyzed various hematological parameters and pulmonary function parameters on three different phases of menstrual cycle (Menstrual phase-2nd day, Proliferative phase -12th day & Secretory phase-22nd day). The study reveals that there is an increase in total leucocyte count, absolute eosinophil count, and platelet count in secretory phase ($P < 0.001$). Neutrophil count is increased in secretory phase, when compared to proliferative phase and menstrual phase. There was a marked increase in lymphocyte count in all the three phases. No significant changes in eosinophil, monocyte, basophil counts ($p < 0.005$). In Pulmonary function test parameters PEFR has not shown any significant difference. FEV₁ and FVC were increased in mid secretory phase, FEV₁/FVC ratio is higher in mid Secretory phase. This study was a moderate attempt to determine regular variations in different hematological and pulmonary function parameters, during different phases of menstrual cycle in normal healthy females and evaluate various conflicting reports on female subjects.

Keywords: Menstrual cycle, Pulmonary function, Proliferative phase, Secretory phase, PEFR, FEV₁, FVC

INTRODUCTION

The menstrual cycle is the scientific term for the physiological changes that can occur in fertile women for the purposes of sexual reproduction and fertilization. The menstrual cycle is under the control of endocrine system which is necessary for reproduction. Each menstrual cycle represents a complex interaction between the hypothalamus, pituitary gland, ovaries, and endometrium. Cyclic changes in gonadotropin and steroid hormones induce functional as well as morphologic changes in the ovary, resulting in follicular maturation, ovulation, and corpus luteum formation. Regulation of menstruation depends on the interaction of hormones from the hypothalamus: gonadotropin releasing hormone (GnRH) from the pituitary: follicle stimulating hormone (FSH), and luteinizing hormone, from the ovary: estradiol and progesterone. It is commonly divided into three phases: the. Menstrual phase, Proliferative phase, & Secretory phase. Stimulated by gradually increasing amounts of estrogen in the follicular phase, discharges of blood (menses) slow then stop, and the lining of the uterus thickens. Most menstrual cycles are 21-35 days long but variability is common after menarche (the first period)

and also before menopause [1]. The hormone secreted by ovary such as oestrogen and progesterone which is Under the influence of hypothalamo pituitary axis activity has a role in altering the hematological and pulmonary parameters [2]. Most commonly the organs in the body remain unaffected by these hormonal imbalances. It is also observed that hematological and pulmonary function test parameters are accompanying the various phases of menstrual cycle. Hemorrhages and fluctuations in the oestrogen and progesterone levels in blood during menstrual cycle has an effect on blood volume & pulmonary function parameters [3].

A woman's period may not be the same every month, and it may not be the same as other women's periods. Periods can be light, moderate, or heavy, and the length of the period also varies. While most menstrual periods last from three to five days, anywhere from two to seven days is considered normal. For the first few years after menstruation begins, periods may be very irregular. They may also become irregular in women approaching menopause. Sometimes birth control pills are prescribed to help with irregular periods or other problems with the

***Corresponding Author:**

Dr. N. Kannan,

Associate Professor, Department of Physiology,
Melmaruvathur Adhiparasakthi Institute of Medical Sciences,
Melmaruvathur, Tamilnadu, India

menstrual cycle [4]. Menstruation begins on day 1 and continues until about 4 or 5 days. Menstrual extends from about day 5 to about day 13. Ovulation occurs on day 14. Secretory phase extends from day 15 to the end of the cycle, day 28. The menstrual cycle is measured from the first day of menstrual bleeding, day 1 up to day 1 of the next menstrual bleeding. Although 28 days is often cited as the “regular” cycle length, only 15% of women actually have such a cycle. A teen's cycles tend to be long (up to 45 days), growing shorter over several years between ages 25 and 35, most women's cycles are regular, generally lasting 21 to 35 days. Around ages 40 to 42, cycles tend to be the shortest and most regular. This is followed by 8 to 10 years of longer, less predictable cycles until menopause [5]. So we attempted this study to understand the variations in hematological and respiratory parameters particularly in different phases of menstrual cycle (Menstrual phase 2nd day, Proliferative phase 12th day Secretory phase 22nd day).

MATERIALS AND METHODS

The present study was carried in between (2009-2010) in healthy female volunteers aged between 18 - 23 years were selected with the normal menstrual cycle of 30±3 days. The study protocol was explained to the subjects and oral informed consent was obtained.

Inclusion criteria: This study includes, healthy south Indian women population of age group 18-23 years having regular menstrual cycles were chosen.

Exclusion criteria: Use of contraceptive pills, lactating women, H/O diabetes mellitus, cardiovascular abnormalities, psychiatric illness.

Hematological parameters determination

Blood samples were drawn from antecubital vein (2.5 ml) in a wax coated containing EDTA as anticoagulant. The first sample was taken on 2nd day of onset of menstruation (Menstrual phase.) Second sample during 12th day of Proliferative phase, and the third sample were collected 22nd day during (Secretory Phase). Four different samples for each phase were collected at different intervals to avoid diurnal variations. The parameters analyzed were Total Leucocyte Count (TLC), Absolute Eosinophil Count (AEC) & Differential leucocyte Count (DLC) of neutrophils, eosinophils, basophils, lymphocytes, monocytes. Total platelet count (1% ammonium oxalate), Absolute Eosinophil count (Pilot's fluid) & Total leucocyte count (Turk's fluid) was done by haemocytometer. Differential leucocyte count by tally-bar method. Bleeding time by Duke's method, clotting time by capillary glass tube method [6, 7, 8, 9]

Pulmonary function parameters determination

Peak Expiratory Flow rate (PEFR), forced expiratory volume in one second FEV₁, forced vital capacity FVC & FEV₁/FVC of each subject were recorded in sitting position. Subjects were asked to take in a deep breath and exhale forcefully into the tube by closing the nostrils. Three recordings were done for each test in the interval time of two minutes and the best out of three were taken for consideration and the values are expressed in litres/minute. Prior to that all: age, height, weight were noticed. A demonstration was given to the subject before performing the tests [10, 11, and 12]. These tests were performed during all the phases with a trained person.

Statistical Analysis

Statistical analysis was done by student's t-test. Comparison of data was done by using one way ANOVA. P value of less than 0.05 indicates statistically significant. The results are expressed as Mean ± SEM (Standard error of mean).

RESULTS

Table.1, Shows Total leucocyte count of healthy female of south Indian rural population in the age group of 18 to 23 years during different phases of menstrual cycle, there was a statistically increase in Total leucocyte count (TLC), Absolute eosinophil count (AEC) and Platelet count during the Secretory phase, P<0.005.

Table.1: Hematological parameters in different phases of menstrual cycle

Parameters	A=Menstrual phase 2 nd day	B=Proliferative phase 12 th day	C=Secretory phase 22 nd day	Significance p value < 0.005
Total leucocyte count /mm ³	6783± 2.43	6794± 1.10	6844± 1.11 ^{AB}	Significant
Absolute eosinophil count/mm ³	160± 43.44	158± 40.12	164± 52.44 ^{AB}	Not significant
Total platelet count lakhs/mm ³	3.42± 0.42	3.85± 0.70	4.21± 0.34 ^{AB}	Significant

Legend: *** p<0.005, ** p<0.05 Increase in TLC, AEC, platelet count in Secretory phase

Table.2, There was a significant rise in neutrophil count during Secretory phase, when compared to proliferative phase. Lymphocyte count increased in all three phases of menstrual cycle. No significant changes in basophil, monocyte, eosinophil. P< 0.005.

Table.2: Differential leucocyte count in different phases of menstrual cycle

MENSTRUAL PHASES	Neutrophil (%)	Lymphocyte (%)	Monocyte (%)	Eosinophil (%)
A=2 nd day	61.48± 5.44	29.9± 4.42	9.11± 3.60	3.24± 0.81
B=12 th day	59.44± 8.81	30± 6.33	9.66± 4.27	3.20± 0.73
C=22 nd day	69.82± 8.14 ^{AB}	32.724± 7.93 ^{AB}	9.72± 3.33	3.12± 0.11
Significance p value < .005	significant	significant	Not significant	Not significant

Table.3, Peak Expiratory Flow rate (PEFR), has not shown any significant difference. Forced Expiratory Volume in one second FEV1 and forced vital capacity (FVC) were significantly increased in secretory phase, when compared to other phases (p<0.001). The highest mean FEV1/FVC is observed in mid luteal phase was significantly higher than early follicular phase (p<0.005). Values are Mean ± SEM **p<0.005, menstrual phases values versus Secretory **p<0.05 and ***p<0.005, Secretory verses, Menstrual phase. Follicular phase and Proliferative phase has no significant difference.

Table.3: Pulmonary function parameters in different phases of menstrual cycle

MENSTRUAL PHASES	FEV1 L/MIN	PEFR L/MIN	FVC L/MIN	FEV1/FVC L/MIN
A=2 nd day	1.63± 0.04	283.28± 9.33	1.800± 0.045	0.79± 0.01
B=12 th day	1.62± 0.003	280± 9.13	1.82± 0.438	0.80± 0.01
C=22 nd day	1.98± 0.006 ^{AB}	304± 10.08	2.448± 0.079 ^{AB}	0.98± 0.01 ^{AB}

DISCUSSION

Periodical change occurs in anatomical architect and hormonal fluctuation during menstrual cycle in females. It is also very much known to have a fluctuation in their hormone concentration. These hormones influence autonomic & metabolic activities. In our study we examined the variations in hematological and respiratory parameters particularly in different phases of menstrual cycle (Menstrual phase 2nd day, Proliferative phase 12th day & Secretory phase 22nd day). Our parameters shows an increase in neutrophil count percentage values during Secretory phase when compared to other phases, this changes is due to hormonal imbalance in ovary. Some studies suggested that estrogen increases granular proliferation. Increase in 17 beta estradiol concentration in circulatory pool of blood, in Secretory phase promotes granulopoiesis, which in turn increases the granulocyte numbers [13]. There was an increase in lymphocyte, TLC, AEC, platelet count during all three phases of menstrual cycle, due to increase in number of natural killer cells and T- helper cells, which is influenced by both ovarian and steroid hormones, which is produced in large quantity during all the three

phases of menstrual cycle[14]. No significant changes were observed in eosinophil, monocyte, basophils. The observations made by (Greenberg G et al 1985, Puranik BM et al 1994, Edward N et al 1996, Moran VH et al 2000, Ogunzugen IK 2002) also showed a marked decrease in eosinophil count during menstrual and proliferative phase, and a rapid increase in the secretory phase, this is due to physiological stress, where the sex hormones and ovarian hormonal variations causing decrease in eosinophil count. The platelet count were increased in all phases of menstrual cycles is due to rapid toxic reabsorption of necrotoxic material from endometrial surface through haemopoietic system. Puranik BM et al 1994, Edward N et al 1996, Moran VH et al 2000, studies showed a rapid increase in platelet count which declines gradually may be due to leuteal hormones which has a inhibitory effect on reticulo endothelial system by decreasing the platelet release. It was found that platelet count significantly increased during proliferative phase, it is due to more release of corticosteroids in the proliferative phase, due to increase in stress response during this phase [16]. In accordingly luteal phase of menstrual cycle showed the peak value in respiratory parameters. Ventilatory functions among the luteal phase showed significantly greater value, because of increase in estrogen secretion and it carried out dominance in rest of the phases. It is considered as progesterone a great stimulant which has role in hyperventilation in luteal phase of menstrual cycle. FEV1 and FVC were increased in luteal phase and FEV1/FVC ratio higher seen in mid luteal phase [17]. In the present study PEFR has not shown any significant difference. The peak rise in progesterone level has a direct correlation with the increased FEV1 & FVC values (Das et al., 1991). The results of present study was comparable with the previously published articles (Rao GS et al. 1991; Rajesh CS et al. 2000), where FVC, TLC, FRC was found to be significantly higher in the luteal phase. They had also reported a significantly lower value of FEF 25-75% in the luteal phase was reported earlier too [Das TK, 1998]. The lungs are able to meet the metabolic need of the body and accordingly the pulmonary function varies during different conditions. Since hormonal levels also vary as per the metabolism, any variation in the female gonadal hormone during different phases of menstruation exerts corresponding changes in the lung functions. In the present study, increase in lung functions like FEV1 and FVC during the Secretory phase were observed and these variations are consistent with previous studies in adult women (Das, 1998; Rao et al. 1991). Milne et al 1979 & Rao et al in 1991 suggested that progesterone induces hyperventilation through both the central medullary and peripheral receptors and the sensitivity of respiratory receptors during the secretory phase and pregnancy is high (Clerici 1999). Our study also shows a higher lung function profiles (FVC and FEV1) observed during menstrual phase when

compared to the follicular phases. This may be a consequence of the withdrawal of smooth muscle relaxant effect of progesterone during menstrual and follicular phases, results in a lower lung airway resistance. In the present study PEFr has not shown any significant difference.

CONCLUSION

From the results we conclude that there was an increase in Hematological Parameters TLC, AEC & Platelet count in secretory phase of menstrual cycle. There was also an increase in neutrophil count in secretory phase of menstrual cycle when compared to proliferative phase. Lymphocytes increased in all the three phases (Menstrual phase 2nd day, Proliferative phase 12th day & Secretory phase 22nd day). We did not find any significant changes in eosinophil, basophil and monocytes. The reason could be due to the changes in hormonal balance in ovary, it is also proved in few studies with increase in 17 beta estradiol concentrations in Secretory phase promotes granulopoiesis which in turn increases the WBC count. Pulmonary function in relation to menstrual cycle shows that PEFr has no significant differences. FEV1 and FVC were increased in Secretory. FEV1/FVC ratios were increased in mid secretory phase this is due to domination of estrogen in follicular phase which in turn increases the resting minute volume in secretory phase.

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