

Original article

Influence of menstrual cycle on PEFR in young healthy Punjabi girls of 18 – 20 years age

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ABSTRACT

Background: Menstrual cycle is categorized as the physiological process, which plays a vital role in the normal reproductive years of the females. This corresponds to the monthly rhythmical variations in the extent of female hormones, which in turn affect the functioning of various body organs. Therefore, interest has peaked in the investigation of relationship between the menstrual cycle and respiratory system functioning.

Objectives: Aim of this study was to analyze relationship between menstrual cycle and peak expiratory flow rate (PEFR) in young healthy Punjabi girls of 18 – 20 years age.

Material and Methods: This study was carried out at Punjab Institute of Medical Sciences Jalandhar, for which, the database of 31 medical girl students (subjects) belonging to the age group of 18-20 years was investigated. A medspiror computerized spirometer was utilized to procure information about the peak expiratory flow rate (i.e., PEFR (L/sec) is a major pulmonary function).

Results: The mean value of PEFR was perceived to be significantly high ($p < 0.05$) during the luteal phase / stage of the menstrual cycle in comparison to the menstrual phase / stage as well as proliferative phase / stage, in case of the young healthy Punjabi girls (subjects).

Conclusions: The measured high values of PEFR in the luteal / secretory stage, and its moderate values in the proliferative / follicular stage of menstrual cycle ($p < 0.05$) clearly indicate that the level of estrogen predominates in the proliferative stage, while the level of progesterone predominates in the luteal stage, in the presented study. However, it is quite evident from the measured lower PEFR values that the levels of estrogen as well as plasma progesterone are approximately negligible in the menstrual phase. Therefore, the hormone therapy may emerge as an appropriate approach for the therapy of patients suffering from the premenstrual exacerbation of asthmatic conditions, by utilizing supplement progesterone hormone along with appropriately recommended bronchodilators, in case of the young healthy Punjabi girls of 18 – 20 years age.

Key Words: Menstrual cycle, progesterone level, reproductive system, pulmonary functions

Introduction

Any change in the female gonadal hormones during the various stages of menstrual cycle leads to inevitable variations in pulmonary functions.^[1] However, the hormonal levels keep on changing due to metabolic phenomena.^[2, 3] Some researchers have established relationship between the lung

functions and body mass index,^[4, 5] which is also associated with the obesity level and menstrual cycle,^[6] for the female patients (subjects). However, some investigators suggested the possible role of sex hormones, especially progesterone in treatment of asthmatic female patients.^[1] They also observed reduction in forced expiratory volume 1 in Korean

girls (subjects) during the menstruation period in comparison to other subjects who were not undergoing menstruation.^[6] Among three phases of menstrual cycle (i.e., menstrual stage, proliferative stage and luteal stage), the enhanced ventilation was observed in the luteal stage might be correlated to the higher progesterone levels resulting in a boosted inspiratory muscle endurance as well as bronchial smooth muscle relaxation.^[7] Therefore, the utilization of progesterone in place of the steroid may be prescribed in case of asthmatic conditions in young girls. However, the blood progesterone levels must be observed concurrently, so that its accurate relation with enhanced lung functioning in the luteal stage may be established.^[7]

Better pulmonary function values in luteal / secretory stage can be attributed to the bronchodilating effect of progesterone by non-genomic action.^[8] Moreover, the respiratory center stimulation by progesterone can be a mechanism to attain improved results in the luteal / secretory phase.^[9] The beneficial role of these hormones was confirmed in ameliorating asthma exacerbation.^[10] Females, for largely unspecified causes, are gradually getting affected due to inflammatory lung infections; such as asthma, chronic obstructive pulmonary diseases, cystic fibrosis, and they are experiencing excess morbidity as well as mortality due to such disorders after adjusting smoking factor. This is reckoned to be a well-known fact that at least one-third of the females experience deterioration of asthmatic symptoms during the premenstrual or menstrual stages of their respective menstrual cycle.^[11] A few researchers recommended to supplement progesterone hormone in addition to bronchodilators, and they had observed improved results in the case of female patients (subjects) under bronchial asthmatic conditions and acute exacerbations.^[12]

Experimental evidences connoted that physiological concentration of progesterone lead to enhanced mRNA constituent of progesterone receptor at hypothalamus in secretory stage. Therefore, stimulatory impact on such receptors results in hyperventilation,^[13, 14] and thereby induces enhancement in the lung functions.^[15-17] The study presented by Mannan et al.^[14] was conducted to investigate pulmonary function status in various stages of menstrual cycle in order to identify correlation between the progesterone level and the value of lung functioning parameter PEFR under various stages of menstrual cycle in case of healthy adult females. However, the detailed archive available to showcase the effects of sex hormones on the pulmonary functions are debatable, and hence need further evaluation to enable doctors to formulate advantageous treatment regimes.^[11] Therefore in the presented research work, we focus on the influence of menstrual cycle on PEFR in young healthy Punjabi girls of 18 – 20 years age.

Material and Methods

The ethical/research approval for this study, done within the Physiology Department, was granted by the Institutional Committee of the Punjab Institute of Medical Sciences (PIMS) Jalandhar (affiliated to Baba Farid University of Health Sciences, Faridkot, India). As per the protocol, the participation was voluntary, and the subjects/participants were intimated regarding the purpose and nature of the research work under investigation. This study was attempted on MBBS female students. In this, 31 healthy girl students (subjects having regular menstrual cycle) aged between 18 to 20 years belonging to the Punjabi population were selected for the desired study.

A written consent was procured from all the subjects, and whole procedure was explained to them, which included Medspiror computerized spirometer. A detailed review of their medical

history as well as physical examination were exercised.

Subjects with known respiratory, cardiovascular, neuromuscular diseases, diabetes mellitus, thyroid dysfunction and/or with history of any drug intake were excluded from the research data collection. Particularly, the girls/subjects exhibiting history of hormone replacement therapy, oral contraceptives, COPD or asthma were not involved in this study.

It is noteworthy fact that same spirometer was utilized throughout the study; and the tests were performed by the same technician.

The height of each subject was also measured in the standing and erect posture by utilizing a standard measuring tape. Their weight was recorded by using a standard weighing machine. A comprehensive questionnaire was utilized to know the menstrual cycle pattern of each girl subject, and they were requested to visit the Laboratory of Physiology Department three times during the various stages of their menstrual cycle i.e., in the

menstrual phase (measurement taken on 3rd day of the cycle), in the proliferative / follicular phase (measurement taken on 12th day of the cycle) and in the luteal / secretory phase (measurement taken on 22nd day of the cycle).^[1, 10, 11, 18]

Minimum three readings were recorded for each subject, and the average of three was chosen for the analysis.

The observed data was analyzed using the standard statistical technique (i.e., the paired samples t-test, in which the p-value < 0.05 indicates statistically significant result), based on N number of subjects/participants.

Results

We have calculated mean and standard deviation for the observations obtained corresponding to the peak expiratory flow rate (i.e., PEFR (L/sec)), which are represented as Mean ± Standard Deviation in Table 1, and the statistical comparison of PEFR values is illustrated in Table 2.

Table 1: Mean PEFR Observations for Healthy Punjabi Girls of 18 – 20 Years Age

Phase of Menstrual Cycle	Mean Value of PEFR
Menstrual Phase	4.95 ± 0.99
Proliferative Phase	5.69 ± 0.47
Luteal Phase	6.37 ± 0.51

Table 2: Statistics for Significant Results Corresponding to Aforementioned Subjects

PEFR Values are Substantially Higher in	p-Value	Result/Observation
Proliferative Phase than in Menstrual Phase	< 0.05	Significant
Luteal Phase than in Menstrual Phase	< 0.05	Significant
Luteal Phase than in Proliferative Phase	< 0.05	Significant

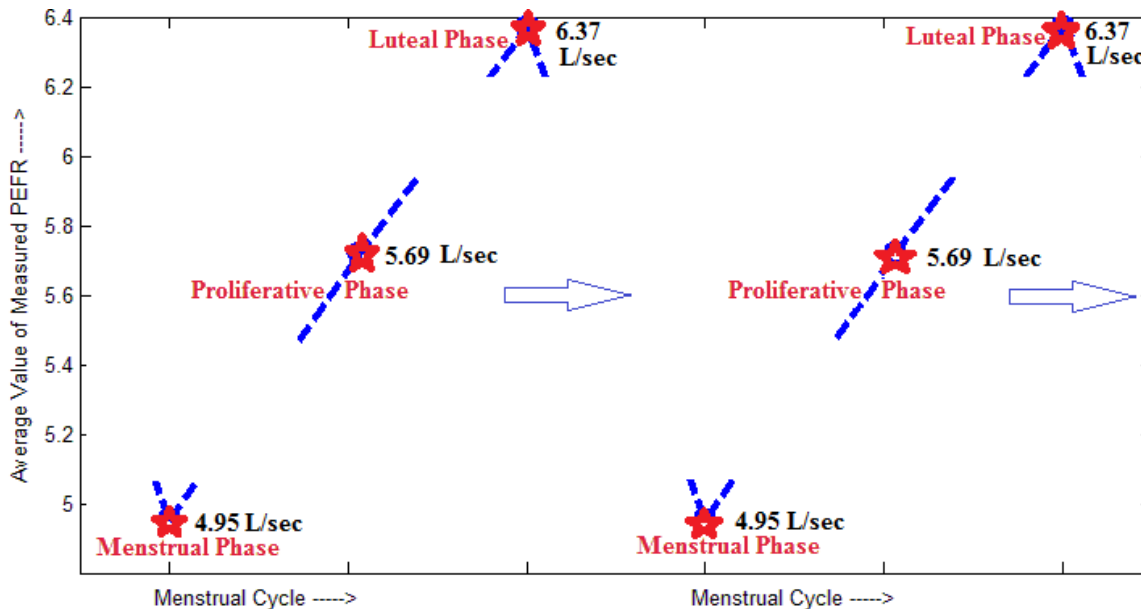


Figure 1: Mean Values of Measured PEFR (L/sec) in Three Phases of Menstrual Cycle

It is apparent from the results demonstrated in Table 1 and Figure 1 that the average PEFR value is highest in luteal stage, and it is found to be least in the menstrual phase.

However, the mean PEFR value is significantly more in the proliferative stage as compared to its value in the menstrual phase, which is supported by the corresponding p-value < 0.05 in Table 2 and Figure 1. However, the mean PEFR value in the luteal stage is substantially higher than its value in the menstrual stage, which is reflected by the corresponding p-value < 0.05 in Table 2 and Figure 1. It is noteworthy that the elevated level of progesterone was inferred to exhibit positive correlation with the peak expiratory flow rate values in the secretory stage of menstrual cycle.

Discussion

The major motive of the concerned study was to explore the influence of menstrual cycle on the peak expiratory flow rate in the young healthy Punjabi girls of 18 – 20 years age. As the hormone level attains very low level during the menstrual stage, therefore this stage was assumed to be the baseline, and considered to exhibit the low

correlation with PEFR.^[14] The variations in the level of estrogen and progesterone in the various stages of menstrual cycle have been cited as the cause of the changes in lung functions.^[19] The maximum difference in the values of PEFR was observed between the menstrual and luteal / secretory phases.

The plasma level of progesterone was reported to be substantially higher in the secretory stage in comparison to those of proliferative stage.^[14]

It leads to hyperventilation by direct stimulation of respiratory center and also increases oxygen consumption because of elevated metabolic rate.^[15] The progesterone can potentiate prostaglandin generated relaxation of bronchial smooth muscle. Typically, the positive correlation of plasma progesterone with PEFR was also in support of the fact that the elevated progesterone level results in enhanced functioning of lungs, in the luteal phase.^[13]

On the contrary, Chong et al.^[20] found that the menstrual cycle had a very low impact on PEFR in healthy non-asthmatic Asian females. However, Rajesh et al.^[21] conducted a study to demonstrate

that the majority of pulmonary functions reflected better values in the secretory stage in comparison to the proliferative stage. Here, the progesterone induces hyperventilation and hypercapnia in the secretory stage of a regular menstrual cycle.

The oxygen consumption was significantly higher in the secretory stage in comparison to other two stages, whereas it was approximately similar in the menstrual and proliferative stages.^[22] The elevated oxygen consumption was observed to be a post-ovulatory phenomenon, which is likely to be mediated through hormones, mainly progesterone. This surge in oxygen consumption was particularly metabolic, and it is dependent on the pattern of food consumption behaviour in menstrual cycle.

In the presented study in the case of young healthy Punjabi girls, we observed that the mean value of PEFR is on the higher side in the luteal stage and on the lower side in the menstrual stage. Although the mean value of PEFR is significantly more in the proliferative phase than its value in the menstrual phase, yet it is substantially lower than the values of PEFR measured in the luteal phase. These observations suggested a viable role in boosted level of progesterone in secretory stage on the respiratory system. Similar inference was reported by the different researchers/investigators in different population groups,^[1 – 12] and the results illustrated in this correspondence are in close agreement with those.

Concluding Remarks

In this correspondence, we have presented the details of the study conducted at PIMS to investigate the influence of menstrual cycle on PEFR in young healthy Punjabi girls of 18 – 20 years age. The concerned research findings have clearly delineated a relationship between the peak expiratory flow rate values (lung function) and the different phases of menstrual cycle.

The statistical observations based on the measured PEFR values indicate a crucial role of progesterone hormone as the bronchial muscle relaxant, and its contribution towards the enhanced muscle fortitude. However, the improved values of pulmonary functions during the proliferative as well as luteal stages can be attributed to the increased level of progesterone. Moreover, the best PEFR results obtained during the luteal phase enable the physicians to reduce the steroid dosage of asthmatic patients/subjects. It is noteworthy that the PEFR values in menstrual phase must be examined carefully while treating the asthma disease during the menstrual cycle of Punjabi girl patients.

Future work includes the investigation of systematic distinctions in eating, sleeping habits, body mass index, particularly sexual behaviour as well as health patterns across females' menstrual cycles,^[3] for the Punjabi population.^[18]

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