



VARIATION IN PULMONARY FUNCTION PARAMETERS DURING DIFFERENT PHASES OF MENSTRUAL CYCLE AMONG HEALTHY ADOLESCENT GIRLS.

Physiology

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ABSTRACT

Background: The characteristic rhythmic changes in the rate of secretion of ovarian hormones during different phases of menstrual cycle produce physiological changes in various organ systems, including the respiratory system.

Aim: To assess and compare pulmonary function parameters during follicular and luteal phase of menstrual cycle.

Material and methods: Pulmonary function parameters like Vital Capacity, Forced Vital Capacity (FVC) and Forced Expiratory Volume in 1 sec (FEV₁) were measured in 38 first year medical female student's volunteers with regular menstrual cycles, during follicular and luteal phases of menstrual cycle, which was statistically analyzed.

Result: The mean value of TV, FVC and FEV₁ were more during the luteal phase which was statistically significant.

Conclusion: The pulmonary function parameters which were measured were better during the luteal phase of the menstrual cycle as compared to those in the follicular phase.

KEYWORDS

female students, follicular phase, luteal phase, menstrual cycle, pulmonary function.

INTRODUCTION

Menstruation is a physiological phenomenon which occurs in women during her reproductive years. Menstrual (ovarian) cycle occurs in two phases- follicular and luteal phase, which are regulated by sex hormones: estrogen and progesterone¹. The characteristic rhythmic changes in the rate of secretion of ovarian hormones produce physiological changes in the brain, in the musculoskeletal system, cardiovascular and pulmonary functions, in addition to changes in the reproductive system². Changes in lung function have been reported in different phases of menstrual cycle owing to the action of the hormone progesterone. Progesterone has been reported to have a role in relaxation of bronchial smooth muscle which reduces the contractile response of these respiratory muscles³.

Studies have shown that the increase in expiratory resistance during follicular phase of the menstrual cycle may be contributing to the changes in pulmonary system of females⁴. The increased ventilation seen in luteal phase might be related to high progesterone levels bringing about an increased inspiratory muscle endurance and bronchial smooth muscle relaxation⁵. There are contradictory reports on pulmonary function in different phases of menstrual cycle. Some studies have reported changes in pulmonary function in luteal phase of menstrual cycle^{5,6}. While others have failed to find any significant relationship between phases of menstruation and pulmonary function⁹. There are only few studies from India on pulmonary function tests in different phases of menstrual cycle^{5,7}.

With this background, the present study will be carried out to observe the status of pulmonary function parameters during different phases of menstrual cycle among healthy adolescent girls.

AIM

To assess and compare pulmonary function parameters during follicular and luteal phase of menstrual cycle among healthy adolescent girls.

METHODOLOGY

Study design: Descriptive study.

Study setting: Department of Physiology, Government Medical College, Kannur.

Study population: First year female medical students of GMC, Kannur.

Study Period: Three months.

Sample size: 38

$N = [(Z1 - \alpha/2 + Z1 - \beta)^2 / \Delta^2] + [(Z1 - \alpha/2)^2 / 2]$

Δ : Effect size = $(\mu_1 - \mu_2) / \sigma = 0.47$

$\sigma = (\sigma_1 + \sigma_2) / 2 = 0.96$

where,

μ_1 : Pre -test mean = 5.33³

μ_2 : Post -test mean = 5.753

σ_1 : Standard deviation in pre-test = 0.923

σ_2 : Standard deviation in post-test = 13

α : Significance level = 5%

$1 - \beta$: Power = 80%

Sampling: Consecutive sampling. Inclusion criteria: First year medical students, who are willing to participate in the study, having regular menstrual cycles of 21-35 days.¹ Exclusion criteria: Past or present history of respiratory illness, On oral contraceptive pills.

MATERIALS AND METHODS:

Permission from the Head of the Institution has been taken to include first year medical students in the study. Ethical clearance will be obtained from the Institutional Ethical Clearance Committee of GMC, Kannur for the conduct of the study. Subjects will be enrolled in the study after taking written informed consent. A self-structured questionnaire was used to record the menstrual history. Anthropometric measurements like height (meter), weight (kilogram), waist and hip circumference (centimeter) will be measured and body mass index (BMI in kg/m²) and waist hip ratio (WHR) will be calculated. Vital parameters such as Pulse rate (beats/min), Blood Pressure (BP in mmHg), Respiratory Rate (breaths/min) will be recorded. TV (Volume of air breathed in or out of lungs, during quiet respiration), FVC in liters (Forced Vital capacity: Maximum volume of air which can be breathed out as forcefully and rapidly as possible following a maximum inspiration) and FEV₁ in liters (Volume of FVC expired in first second of exhalation) was recorded using the computerized machine Spiro excel during different phases of menstrual cycle in adolescent girls in sitting posture. Before the test, the subject will be made familiarized with machine and detail instructions cum demonstrations will be done. For each subject, procedure will be repeated thrice, and the maximum value will be considered for the study.

From the date of onset of menstrual cycle probable date of ovulation will be calculated, based upon which the duration of different phases of cycle will be determined. Menstrual phase will be based on the subject's statement. Each subject will be given two specific dates as per their menstrual cycle to report to the department two times -one during follicular phase and again during luteal phase of menstrual cycle. Ventilation recorded on 8th-12th day of the cycle, will be considered as the data for follicular phase and that recorded on 20th-24th day of the cycle will be taken for luteal phase.

Data Management: The data obtained will be entered in Microsoft Excel and necessary coding will be done. Random checks will be done to find out any possible errors and then Statistically analyzed using SPSS software version 16. A 'p' value of less than 0.05 will be considered as significant.

RESULTS:

38 female students were selected for the present study. The mean age of the study population was 18.48 ± 1.41 years. The TV (ml), FVC (L) and

FEV1 were recorded during the follicular and luteal phases of menstrual cycle.

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Table 1: Pulmonary function parameters during various phases of menstrual cycle.

Pulmonary function Parameters	Phases of menstrual cycle		
	Follicular phase	Luteal phase	
TV (ml)	587±213	697±220	p < 0.001*
FVC (L)	2.58±0.32	2.98±0.34	p < 0.05*
FEV1 (L)	2.24±0.31	2.59±0.28	p < 0.05*

*p < 0.05 will be considered as statistically significant

The mean value of TV, FVC and FEV1 were more during the luteal phase and it was statistically significant.

DISCUSSION

In the present study, TV, FVC and FEV1 was found to be significantly increased during the luteal phase compared to the follicular phase of menstrual cycle. Studies done by Das show significant increase in TV in luteal phase as compared to the early follicular and ovulatory phase of the cycle.⁵ Studies done by Nandhini et al showed Pulmonary function parameters like FVC, Forced Expiratory Volume in first second (FEV1) were significantly higher in secretory phase of menstrual cycle.³ Studies conducted by Rajesh CS et al showed a similar finding of increased FVC in secretory phase of menstrual cycle compared to follicular phase.⁶ These evidences exhibit the presence of a relationship of progesterone with lung function parameters in luteal phase of menstrual cycle.

Progesterone has greater fluctuations during the menstrual cycle and it is a known respiratory stimulant.⁸ It causes increase in lung function parameters during the luteal phase due to hyperventilation.⁵ The importance of gonadal hormones in bringing about changes in pulmonary function has been demonstrated by the fact that there is hyperventilation during luteal phase of menstrual cycle and these cyclic variations disappear in postmenopausal women.¹⁰

The concept of "respiratory endocrinology" reveals the role of hormones in regulation of breathing. Interactions of hormones and breathing open new perspectives for novel pharmacologic therapies of breathing disorders, and challenge for increasing the research of endocrine aspects of control of breathing in health and disease.

Limitation: the study involved only a small group and serum levels of progesterone could not be measured.

CONCLUSION

The pulmonary function parameters which were measured were better during the luteal phase of the menstrual cycle as compared to those in the follicular phase. This suggests a possible role of the increased levels of progesterone during the luteal phase on the respiratory system.

ACKNOWLEDGEMENT:

I acknowledge first year medical undergraduates for volunteering in the study and our former Professor and HOD, Dr. M G Bandelkar for his support in conducting this study.

- Financial support and sponsorship: Nil.
- Conflicts of interest: There are no conflicts of interest.

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