Indian Journal of Basic and Applied Medical Research; June 2020: Vol.-9, Issue- 3, P. 212- 217
DOI: 10.36848/IJBAMR/2020/12225.51640

Original Article

Variation in pulmonary functions with different phases of menstrual cycle

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ABSTRACT:

Menstrual cycle forms an integral part of female reproductive system. Ovarian hormones like estrogen and progesterone plays important role in different phases of menstrual cycle-follicular ,luteal and menstrual phases. It is characterized by periodic vaginal bleeding due to shedding of uterine mucosa. This has its own effect on various systems and metabolisms. The aim of this study was to evaluate variation in pulmonary functions during different phases of menstrual cycle in adolescent girls. 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. In Pulmonary function test parameters FEV1 and FVC were increased in mid luteal phase, FEV1/FVC ratio is higher in mid luteal phase. This study was a moderate attempt to determine regular variations in pulmonary function parameters, during different phases of menstrual cycle in normal healthy females and evaluate various conflicting reports on female subjects.

Key Words: Menstrual phase,Lung functions,Progesterone, Luteal phase.

INTRODUCTION

Lung function changes have been reported in various phases of menstrual cycle owing to the action of progesterone hormone. Progesterone plays a role in bronchial smooth muscle relaxation which reduces contractile property of respiratory muscles[1]. Studies have shown that increase expiratory resistance during follicular phase of menstrual cycle may be contributing to the changes in pulmonary system of females[2]. 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 relaxation. There are only few studies from India on pulmonary function tests in different phases of menstrual cycle. There are contradictory reports on pulmonary function in different phases of menstrual cycle.It is reported that in luteal phase an increased progesterone secretion leads to hyperventilation. In view of the above we planned the present study to evaluate the pulmonary function in different phases of menstrual cycle. With this background the present study was planned to assess the pulmonary function in menstrual, follicular and luteal phase of cycle.

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[3]. 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[4]. 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[5]

. 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 menstrual cycle[6]. 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[7]. So we attempted this study to understand the variations in hematological and respiratory parameters particularly in different phases of menstrual cycle.

METHODS AND MATERIALS:

It was a prospective study ,which was performed in and around of our institution. Sixty healthy females (age range-18-25 yrs, mean height -155 cm ,mean weight -54.5 kg) with regular menstrual . Their lung volumes FEV1 (forced expiratory volume),FVC (forced vital capacity), and FEV1/FVC were measured during various phases of menstrual cycle & Parameters were compared (TABLE -1).

Regularly menstruating adolescent girls were included in this study after taking their written informed consent. Those with a history of chronic pulmonary illnesses or long term relevant medication use (bronchodilators, antitubercular drugs etc) were excluded from the study. A detailed questionnaire was used to assess the pattern of the menstrual cycle,the premenstrual disturbances and the last menstrual period and to rule out allergic respiratory diseases and obesity.The anthropometric measurements and vital parameters were recorded.The preliminary clinical examination of the respiratory system was carried out.Before the test the subject would be familiarized with the machine and the detail instructions cum demonstration up to the satisfaction would be done .PFT were performed after 10 minutes of non-ambulation and before having lunch during the different phases of their cycle i.e. menstrual phase (1-5th day) ,follicular phase (6th – 13th day) and luteal phase (15th –

28th).For each subject ,the procedure was repeated thrice and the maximum value was considered for the study.The respective phases of menstruation were calculated from the day of the last menstrual period and during the usual duration of the menstrual cycle.

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[8,9,10]. 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:

Total 60 girls were enrolled for the study.The complete details for the final assessment were available from all 60 girls (Table -1) mean age 18-25 yrs,height 155cm ,and the mean weight is 54.5kg.

TABLE -1

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	60	18	25	20.15	1.549
HEIGHT	60	151	160	155.62	2.853
WEIGHT IN KG	60	50	65	57.37	3.996

The pulmonary function measures in the group statistics of the menstrual cycle are shown in (Table -2).The mean of the FEV1 was more during the luteal phase and it was statiscally significant.The mean of the FEV1 was more during the luteal phase as compared to that in the follicular and the menstrual phases and it was statiscally significant .FEV1/FVC ratio was more in the luteal phase as compared to those in follicular and the menstrual phases and this was statiscally significant. The high doses of progesterone throughout the menstrual cycle prevented the deteriotion of the premenstrual exacerbation of pulmonary functions measures over the phases of menstrual cycle (n=60). All analyses were two tailed and $p < 0.05$ was considered significant.

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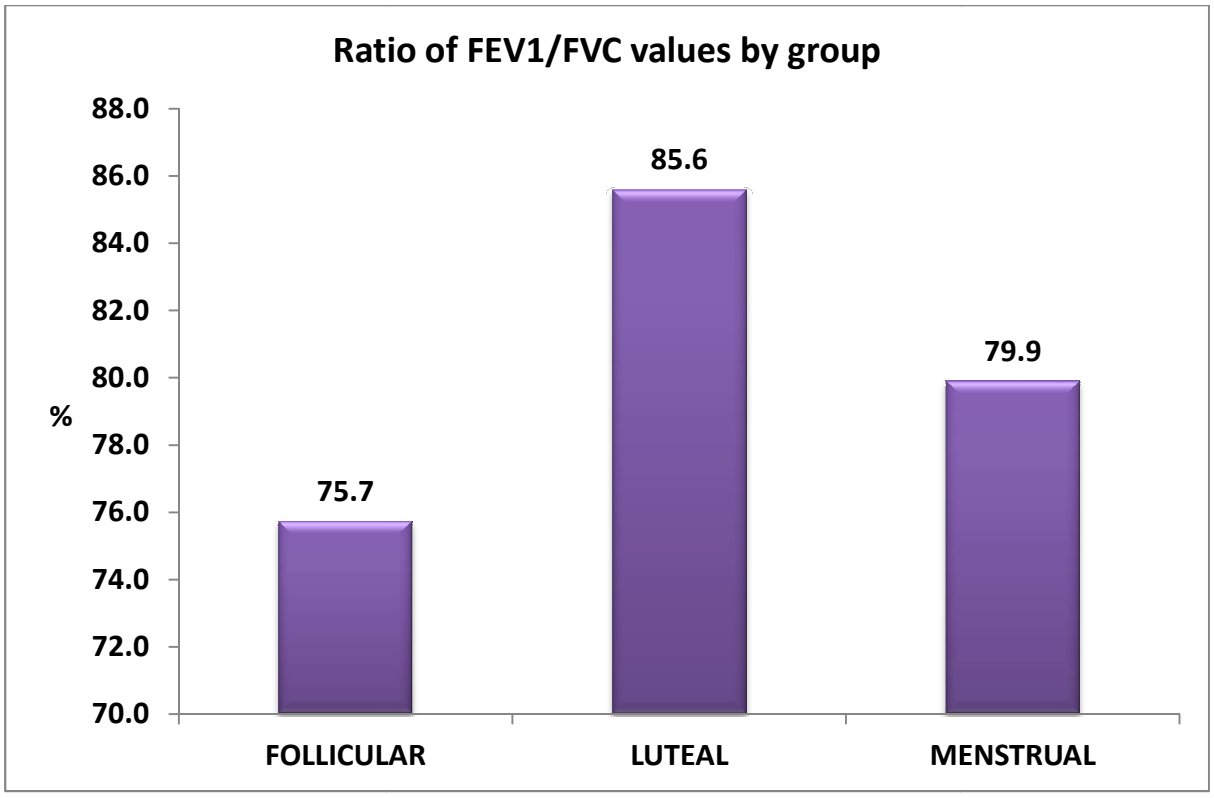
TABLE -2

Pulmonary function test					
	GROUP	N	Mean	Std. Deviation	P-value
FEV1	FOLLICULAR	60	1.22	.20	0.001
	LUTEAL	60	1.38	.29	
	MENSTRUAL	60	1.21	.25	
FVC	FOLLICULAR	60	1.59	.25	0.607
	LUTEAL	60	1.61	.29	
	MENSTRUAL		1.54	0.24	
FEV1/FVC	FOLLICULAR	60	76.733	11.1733	0.000
	LUTEAL	60	85.600	10.2233	
	MENSTRUAL	60	79.901	11.4522	



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 The present study demonstrated better pulmonary functions which were

measured as the lung volumes and capacity during the luteal phase of menstrual cycle as compared to those in the follicular and menstrual phases in the regularly menstruating adolescent girls.

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[11] Chen et al [12]measured the pulmonary functions and compared in the midfollicular phase and in the midluteal phase in 30 healthy women.They concluded that the inspiratory muscle endurance was higher in the midluteal phase and that it was lower in the midfollicular phase. Chong et al[13], stated that the menstrual cycle appeared to have little effect on the peak expiratory flow rate in healthy,non-asthmatic,Asian women. Therefore ,this result did suggests the possibility of ovarian hormone effects on the contractile component or on respiratory motor control,as previously reported by Zabka et al[14].Evidence for an increasing number of progesterone receptors induced by estadiol in the luteal phase has been found in rats by MacLusky and McEven[15]. Das TK[11] , states that use of progesterone in hypoventilation syndrome,obesity and emphysema has been by its virtue of increasing the sensitivity of the respiratory neurons to co2 ,producing a stimulatory effect directly on the medullary receptors,thus indicating the role of progesterone on the pulmonary function.Beyon et al[16] reported that administration of high doses of progesterone throughout the menstrual cycle prevented the deterioration of the premenstrual exacerbation of asthma,the withdrawl of progesterone therefore,is expected to cause lower flow rates during the premenstrual and menstrual phases. The results of present study was comparable with the previously published articles (Rao GS et al. 1991), where FVC, TLC, FRC was found to be significantly higher in the luteal phase. 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 luteal and 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.

CONCLUSIONS:

The pulmonary functions were better ,which were measured as the lung volumes and capacities,during the luteal phase of the menstrual cycle as compared to those in the follicular and the menstrual phases in regularly menstruating adolescent girls.This suggests a possible role of the increased levels of progesterone during the luteal phase on the respiratory system.

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Date of Submission: 07 February 2020 Date of Peer Review: 11 March 2020

Date of Acceptance: 19 May 2020 Date of Publishing: 02 June 2020

Author Declaration: Source of support: Nil, Conflict of interest: Nil

Ethics Committee Approval obtained for this study? YES

Was informed consent obtained from the subjects involved in the study? YES

For any images presented appropriate consent has been obtained from the subjects: NA

Plagiarism Checked: Urkund Software

DOI: 10.36848/IJBAMR/2020/12225.51640