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comparative study of volumetric changes in body parameters and in respiratory system using computerized spirometer in teenage girls before and after menstruation

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Abstract :

ABSTRACT Background Menstruation is a cyclic event with endometrial sloughing and shedding due to the effect of hormones produced by the hypothalamo pituitary ovarian axis (also termed as the HPO axis). From the hypothalamus GnRH is released in pulses, to the anterior pituitary, stimulating the gonadotrophs, which in turn synthesize, store and secrete gonadotropins FSH and LH and stimulate the gonads to synthesize and secrete sex steroids. Aim The aim of this study is to compare and find out the variations in body weight, heart rate, respiratory rate, blood pressure and the volumetric changes in the respiratory system pre and post menstrually in teenage girls. Methods The test was performed using computerized spirometry in two different phases of the menstrual cycle the follicular phase (FP) and the luteal phase (LP). The study variables were weight (Wt), heart rate (HR), respiratory rate (RR), blood pressure (BP), forced expiratory volume (FEV1), forced vital

capacity (FVC) and forced expiratory volume (FEV1/FVC) values. The details on the menstrual history of the subject for its regularity were collected. Those with regular cycles were examined and the body parameters and the flow volume curve using computerised spirometry was obtained in the late luteal phase and in the early proliferative phase during the premenstrual and in the postmenstrual phases. Results The results were compared for body parameters, FVC, FEV1, (FEV1/FVC) between the premenstrual and the postmenstrual values. The mean body weight value obtained in the premenstrual period was 58.977.85 and the value in the postmenstrual period was 56.286.46. This difference is considered to be statistically significant. The differences in body weight, HR, RR, BP, FEV1, FVC, FEV1/FVC were found to be significant with the p-value 0.05. Conclusion This study showed that in the luteal phase, the respiratory effort was high and FEV1 showed better values and is due to progesterone which produces a reflex hypoxic drive.

The expiratory effort, inspiratory effort were maximal in the luteal phase with the presence of hypocapnia. The amount of FEV1FVC calculated was more in the premenstrual period(the late luteal phase), by using the computerized spirometry, when compared with the postmenstrual period(the early proliferative phase).

Keyword : Menstrual cycle, Forced Expiratory Volume, Forced Vital Capacity.

Introduction Menstruation is the cyclical, orderly shedding and sloughing of the uterine endometrial lining occurring once in every 28 days in a regular cycle¹. It happens because of hormones and due to the effect of Hypothalamo-Ovarian-Pituitary axis (also known as the HPO axis).

Menstrual cycle gives information on the hormonal status of the subject, this study gives information on the changes that happen in HR, RR, BP and in the respiratory system in teenagers with normal cycle¹. Menstrual cycle involves menstrual, follicular and luteal phases regulated by oestrogen, progesterone, gonadotrophins – leuteinising and follicle stimulating hormone from the anterior pituitary. According to the conventional menstrual dates, the first day of the menstrual bleed is day 1.²

The follicular phase starts from the last day of the menstrual phase till the time of ovulation with an increase in FSH and estrogen levels, which stimulate the formation of primary follicle and causes the proliferation of uterine endometrium. The follicle rupture happens exactly 14 days before the starting of the next period. The luteal phase is from ovulation till the starting of the next cycle. The luteal phase has a LH surge 9-16 hours before ovulation.

Figure 3

Comparison of FEV1 and FVC values in the premenstrual and in the postmenstrual period.

FEV1/FVC% in the premenstrual period showed good peaks when compared to the postmenstrual phase which showed very less peaks proving that the premenstrual phase had excellent parameters for respiration. □

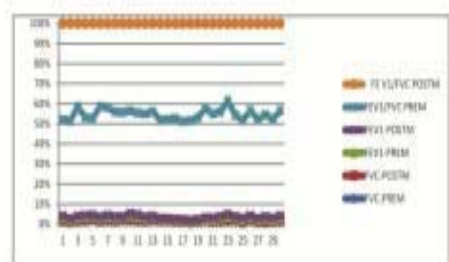


Figure 2(b)

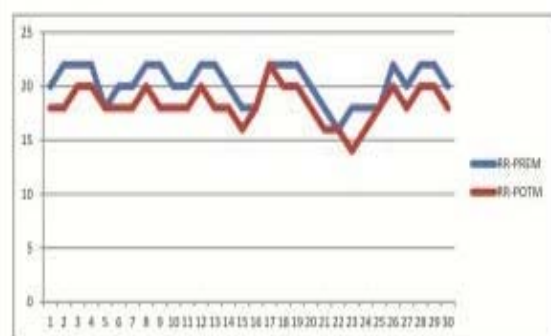
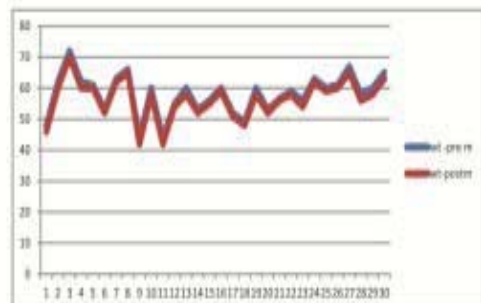
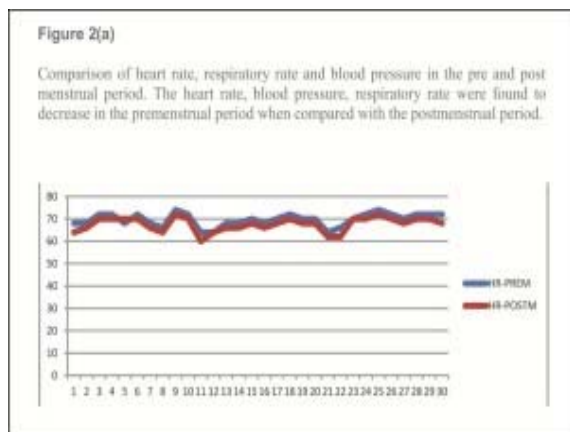


Figure 1

Shows the comparison of body weight in the premenstrual and in the postmenstrual period, showing a mild decrease in body weight in the post menstrual period. (prem represents premenstrual and postm represents postmenstrual phase)





The aim of this study is to compare the physiological changes that happen in heart rate, respiratory rate and to find out the volumetric changes in the respiratory system pre menstrually and post menstrually in teenage girls. The effect of progesterone in the late luteal phase is compared with the effects of oestrogen in the early proliferative phase causing changes in respiratory rate, heart rate and blood pressure.

Materials and Methods:

This study was conducted after getting clearance from Ethics committee and with the permission letter from the Principal of PSGIMSR for examining the teenage girls studying in the campus.

Study Design and Subjects:

This observational study was conducted in subjects with eumenorrhoeic menstrual history studying in PSGIMS&R campus. Totally 30 students were examined in the late luteal phase and the same 30 students were again examined in the early proliferative phase.

Inclusion Criteria:

Eumenorrhoeic females
No smoking, No alcoholism
Age group 16-19 years

Exclusion Criteria:

Irregular cycles
Regularized after treatment
Family history of DUB

Baseline Examinations:

The subjects were requested to fill in the data collection form. The details on menstrual history were obtained and those with the regular cycles were examined. Baseline examinations included menstrual history, bodyweight, heart rate, respiratory rate, blood pressure and the computerized spirometric values of FVC and FEV1. Body weight was measured without shoes. Heart rate was counted for one full minute, respiratory rate was taken for one full minute; blood pressure measurement was taken by using the auscultatory method. The FVC and FEV1 values using computerized spirometry was taken both pre menstrually and post menstrually and compared.

Results:

The mean body weight, blood pressure, heart rate, respiratory rate, FEV1, FVC, FEV1/FVC% were found to be more in the premenstrual period when compared with the postmenstrual period. The parameters showed significant p-value < 0.05.

Figure 1:

Shows the comparison of body weight in the premenstrual and in the postmenstrual period, showing a mild decrease in body weight in the post menstrual period. (prem represents premenstrual and postm represents postmenstrual phase)

Figure 2(a)

Comparison of heart rate, respiratory rate and blood pressure in the pre and post menstrual period. The heart rate, blood pressure, respiratory rate were found to decrease in the

Parameters	PRE MENSTRUAL	POST MENSTRUAL	P-VALUE	SIGNIFICANCE
Body weight	58.97±7.85	56.28±6.46	0.02	+
Blood pressure	106.67±6.61	98.62±5.81	0.001	++
Heart rate	69.67±2.78	67.59±3.13	0.0001	+++
Respiratory rate	20.33±1.83	18.33±1.75	0.0001	+++
FEV1	1.37±0.62	0.98±0.58	0.0001	+++
FVC	1.84±0.37	1.49±0.44	0.0001	+++
FEV1/FVC%	81.73±10.74	73.14±10.64	0.0001	+++

premenstrual period when compared with the postmenstrual period.

Figure 2(b)

Figure 3

Comparison of FEV1 and FVC values in the premenstrual and in the postmenstrual period. FEV1/FVC% in the premenstrual period showed good peaks when compared to the postmenstrual phase which showed very less peaks proving that the premenstrual phase had excellent parameters for respiration.

Discussion:

Females having regular menstrual cycle by itself form an important entity in a woman's life. Most of the carrier oriented women phase irregular cycles which depends on the irregularity in the cyclical rhythm. Hormonal imbalance, deprivation of sleep, stress and compulsion to achieve targets are the main causes behind irregularity. Ovarian hormones also produce variations in other systems of the body, and in the lungs, reflex hypoxia, hypercapnia & hyperventilation caused by progesterone produces marked variations in the FEV1/FVC%, due to the influence of the female sex hormones controlling the

thoracic pump muscles in the luteal phase. Our study was in symmetry with the previous studies. Progesterone is an anti-inflammatory, anti-aging, neuro-protective hormone, also helping in prevention of future endometrial cancer. Patients on oestrogen therapy having the potential to develop an endometrial cancer must be started on a dose of progesterone.¹ The importance of progesterone and its role in providing a positive respiratory drive is proved in this study.

Conclusion:

Prevention of irregularities in cycles is a necessity in every woman's life. Monitoring hormone levels, regular checking of basal body functions, estimation of FEV1 and FVC values, maintaining normal sleep pattern, adopting stress free life are the essentials in females. The major role done here is by progesterone.

Any irregularities in menstrual cycles will have to be immediately sorted out. The effect of progesterone on respiratory cycle¹¹ is to be estimated and the changes in FEV1 and FVC, FEV1/FVC% must be known to the subject

and the treatment from a pulmonologist and gynaecologist together is always beneficial. From this study we learnt that any case of improper progesterone levels¹² must therefore be subjected to a pulmonologist for respiratory volumetric changes.

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