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Physiology

SYMPATHETIC ACTIVITY DURING DIFFERENT PHASES OF MENSTRUAL CYCLE IN UNDERWEIGHT AND NORMAL HEALTHY FEMALES

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ABSTRACT **BACKGROUND -** To study the sympathetic function tests during the follicular, luteal and menstrual phases of the menstrual cycle in underweight and normal healthy eumenorrheic females.

MATERIALS AND METHODS- Sixty females in the age group of 18-25 years were selected for the study. Two groups were made, Subjects with BMI in between 18.5 to 24.99 kg/m2 (n=30, Normal BMI) and Subjects with BMI < 18.5 kg/m2 (n =30, Low BMI). Sympathetic non-invasive function tests were performed i.e., Isometric handgrip exercise test, cold pressor test and postural challenge test, in both the groups in different phases of menstrual cycle.

STATISTICAL ANALYSIS: Unpaired t-test was performed of sympathetic functions in both the groups. ANOVA test was applied to compare the sympathetic dominance between the two groups.

RESULT: Sympathetic dominance in luteal phase in underweight girls was significant

CONCLUSIONS -Our study shows that blood pressure in the resting state and during the stressful maneuvers like cold pressor test, isometric handgrip exercise and standing from lying posture was highest during luteal phase of the menstrual cycle and lowest in the follicular phase explaining sympathetic dominance in luteal phase correlating premenstrual symptoms

KEYWORDS : Menstrual Cycle, Underweight, Sympathetic Tests, Luteal Phase, RMS Polyrite D

INTRODUCTION

Menstrual cycle is a regular coordinated physiological change in non-pregnant women.

The variation of hormonal concentrations during different phases of the menstrual cycle has a profound influence on autonomic and metabolic activities [1]

Physiologically, Follicular phase is primarily phase of estrogen and luteal phase is primarily phase of progesterone. But in the menstrual phase there occurs sudden drop in estrogen and progesterone levels. These steroids also influence various cardio-vascular system (Blood Pressure, Heart rate, Rhythm and Vascular flow) Substrate metabolism and brain itself [2] Autonomic system is vital to the maintenance of internal homeostasis and achieves this by mechanism that regulates blood pressure, fluid electrolyte balance and body temperature.[3]The sympathetic nervous system helps to control the reaction of the body to stress while the parasympathetic system works to conserve the body resources and to restore equilibrium to the resting state. [3]

Different phases of menstrual cycle are accompanied by variations in autonomic functions up to different degrees. So, any factor which causes disruption of the pattern of menstrual cyclicity in an individual shall also be reflected in her autonomic activity.[4]

AIMS AND OBJECTIVES

To assess the sympathetic responses of young healthy underweight and normal weight females during menstrual, follicular and luteal phases of menstrual cycle.

MATERIALS AND METHODS

Sixty (60) randomly selected Female subjects of age group 18-25 years were chosen.

INCLUSION CRITERIA:

On the basis of International Classification of underweight, overweight and obesity in adults, the study subjects were classified into two groups:

Group I- Subjects with BMI in between 18.5 to 24.99 kg/m2 (n=30, Normal BMI)

Group II- Subjects with BMI < 18.5 kg/m2 (n =30, Low BMI)

EXCLUSION CRITERIA:

Known history of diabetes, hypertension, heart disease or any other medical complications and taking medications which might influence their autonomic functions and BMI were excluded.

Tests for assessing Sympathetic system activity:

1. Handgrip test
2. Cold Pressor test
3. Lying to standing test

Equipment's Used for study:

1. Physiograph machine (RMS POLYRITE D)
2. Hand grip dynamometer
3. Sphygmomanometer and Stethoscope
4. Thermometer
5. Weighing machine
6. Height measuring scale

METHODOLOGY

The Subjects were asked to report to the Physiology Research Laboratory on specific date between 2-4 pm hours of the study. All the subjects were evaluated for the parameters in one sitting. A general physical examination including height and weight and a detailed menstrual history along with subject's physical activity level was obtained. Menstrual cycle characteristics was self-reported and usual cycles was defined as Short (25 days), Normal (26–34 days), or Long (35 days). Cycles defined as irregular if there were 15 days between the longest and shortest cycle in the past 12 months. [5] Age at menarche was obtained through recall method.

Subjects were asked to remove clothes except for light personal clothing. Shoes were also removed. Height and weight were recorded to the nearest 0.1 cm and 0.1 kg respectively. Height was recorded after the subject was standing erect with the head held in horizontal Frankfurt's plane. BMI was computed from height and weight using standard formula (Weight in kg / height in meters2).

Autonomic function tests were carried thrice on each subject under normal resting condition and in various phases of the menstrual cycle to ensure AFT recordings at times of low (Menstrual) and high (Follicular and Luteal) hormonal influence. [6] The time durations for different phases of menstrual cycle are as follows:

1.Menstrual phase: 1st to 5th day of bleeding.
2.Follicular phase: 6th day to 14th day of menstrual cycle.
3.Luteal phase: 15th day to 28th day or the next menstrual bleeding.

In subjects having variations in the duration of menstrual cycle the phases were calculated by considering 14 days duration fixed for luteal phase.

Tests for assessing Sympathetic system activity:

1.Handgrip test:
Procedure: Proper instructions were given to the patient regarding the test. Subject was made to sit comfortably. Basal blood pressure was recorded. Continuous recording of heart rate and blood pressure was done. Maximum voluntary activity in pressing the hand grip dynamometer was recorded. Subject was asked to press the hand grip dynamometer for four minute (30% of maximal voluntary effort) and the change in BP was noted at the first, second and fourth minutes

2.Cold Pressor Test:
Procedure: Proper instructions regarding the test was given to the subject and basal blood pressure was recorded. The subject was asked to immerse her both feet in cold water of 10° C for 1 minute and changes in BP were noted at the first and second minute after the test.

3.Lying to Standing Test:
Procedure: The subject was asked given proper instructions regarding test. Subject was made to lie down for at least 5-10 mins, then her basal BP was recorded. Then she was asked to stand actively taking 2-5 seconds and BP was measured immediately and then at time intervals of 1 min, 2.5 min, 5 min, 7.5 min and 10 min.

STATISTICALANALYSIS

Data was collected in Microsoft Excel; mean, standard deviations of all variables were calculated. Unpaired t-test was performed in both the groups and also for the intra- and inter-phasal comparison of sympathetic function tests in both the groups. ANOVA test was applied to compare the sympathetic dominance between the two groups.

OBSERVATIONS & RESULTS

Table 1 Anthropometric parameters in Normal and Low BMI groups

Parameter	Normal BMI (Mean ± SD)	Low BMI (Mean ± SD)	Unpaired T-test	
			t- value	p-value
Age	18.73±.86	18.23±.77	2.37	0.02
Weight	51.8±4.8	40.3±4.7	9.37	0.0001
Height	158.4±5.3	157.08±5.37	0.95	0.34
BMI	20.6±1.51	16.43±1.66	10.17	0.0001
Age at menarche	13.4±1.77	13.63±1.06	0.61	0.54

Table 2 Sympathetic tests in Normal BMI subjects

AFT	Normal BMI (n=30)			MP Vs FP	MP Vs LP	FP Vs LP
	Menstrual	Follicular	Luteal			
Hand grip test	13.36 ±5.6	15.16 ±7.5	13.06 ±4.56	t=1.05 p=0.29	t=0.22 p=0.82	t=1.31 p=0.19
Cold pressor	10.4 ±4.58	11.3 ±6.2	10.84 ±4.46	t=0.64 p=0.52	t=0.38 p=0.70	t=0.32 p=0.74
Lying to standing (fall in SBP)	6.2 ±3.32	7.03 ±2.9	6.7 ±3.18	t=1.03 p=0.30	t=0.59 p=0.58	t=0.42 p=0.67

Table 3 Sympathetic tests in Low BMI subjects

AFT	Menstrual Cycle Phases			MP Vs FP	MP Vs LP	FP Vs LP
	Menstrual	Follicular	Luteal			
Hand grip test	8.96 ±4.69	10.5 ±7.2	12.8 ±7.44	t=0.98 p=0.33	t=2.39 p=0.02	t=1.21 p=0.22
Cold pressor	12. 6±4.58	11 ±5.4	14.46 ±6.34	t=1.23 p=0.22	t=1.30 p=0.19	t=2.27 p=0.02
Lying to standing (fall in SBP)	6.2 ±4.05	5.68 ±4.31	7.8 ±2.99	t=0.48 p=0.68	t=1.74 p=0.08	t=2.21 p=0.03

DISCUSSION

Present study comprises of group of sympathetic Function Tests, performed during the three phases of menstrual cycle, in normal BMI (n=30) and low BMI (n=30), healthy female subjects, aged 18-25 years, studying in Sri Aurobindo Medical College and Post Graduate Institute, Indore, M.P.

In the present study when handgrip test, cold pressor and lying to standing (sympathetic tests) were applied, there were changes in systolic and diastolic blood pressure in all the phases of menstrual cycle in normal and low BMI girls but the changes were more pronounced in the diastolic blood pressure of low BMI girls.

On intraphasal comparison it was found that there was significant change in diastolic blood pressure only in low BMI girls when follicular and luteal phase were compared. Increase in systolic and diastolic pressure observed in the present study due to sympathetic dominance in this phase. These results are in consistent with the results other authors [7,8] where they found that baroreflex sensitivity was greater in luteal phase when both estrogen and progesterone were markedly elevated.

In the present study, mean systolic blood pressure response to cold pressor test was higher in the luteal phase compared to menstrual and follicular phases in low and normal BMI subjects.

Individual's body fat content is known as an important variable in influencing the autonomic neural reactivity. The BMI has been reported as the second major determinant of autonomic nervous modulation in an individual while age per se remains the primary determinant. [9] They observed lowest values HR variability in women with a BMI less than 19 kg/m2. Ishizawa et al [10] and Petretta M et al. [11] in their studies found increased heart rate in thin young low BMI women and according to them it was due to reduced parasympathetic responsiveness and increased cardiovascular sympathetic responsiveness. Rolinda R et al [8] concluded that pain perception varies across the menstrual cycle as shown by higher pain threshold and tolerance during follicular phase of menstrual cycle and so less pain is felt during earlier phases of cycle. Same were the observation of Hapidou and Catanzaro. [12]

They also demonstrated a significant correlation between the serum progesterone level and reduced activation time during the luteal phase suggesting progesterone to be pronociceptive. Animal studies indicates that the induction of luteinizing hormone (LH) surge leads to a diminished analgesic response to morphine resulting from desensitization of brain opiate receptors.[13] Thus, one can speculate that hormonally induced opiate receptor desensitization could enhance luteal phase pain sensitivity among women during this phase.

CONCLUSIONS

The regulation of autonomic tone is modified during the normal, regular menstrual cycle, with highest sympathetic outflow in the luteal phase, compared to follicular phase in both the groups. These changes in sympathetic responses are more pronounced in low BMI group as compared to normal BMI.

The alteration in the balance of the ovarian hormones affecting cardiac autonomic activity might be responsible for these changes. However, BMI is a major determinant of cardiac autonomic modulation since it affects the levels of ovarian hormones

REFERENCES

1. A study of cardiovascular sympathetic function tests during different phases of menstrual cycle in young females Shampa Das, Sumana Panja, Kaushik Samajdar
2. Leicht AS, Hirning DA, Allen GD; Heart rate variability and endogenous sex hormones during the menstrual cycle in young women. Experimental physiology, 2003; 88(3): 441-446.
3 Benarroch EE. The Central autonomic network in Clinical Autonomic Disorders 2nd ed. Low P (ed). Philadelphia: Lippincott-Raven Publishers 1997; pp.17-22.
4 Granot M, Yarnitsky D, Itskovitz.Eldor J, Granovsky Y, Peer E, Zimmer E Z. Pain perception in women with dysmenorrhea. Obstetrics & Gynecology 2001;98(3):407-411.
5 Wei S, Schmidt MD, Dwyer T. Obesity and menstrual irregularity: Associations with SHBG, testosterone and insulin. Obesity 2009;17(5):1070–1076.
6. Shetty SB, Pai SR, Nayanatara AK, Shetty BA. Comparison of cardiac autonomic activity and BMI in different phases of menstrual cycle using Heart rate variability. International Journal of Biomedics and Research 2011;2(10):402-9.
7. Tanaka M, Sato M, Umehara S, Nishikawa T. Influence of menstrual cycle on baroreflex control of heart rate: comparison with male volunteers. Am J Physiol Regul Integr Comp Physiol 2003;285: R 1091-R1097.
8. Rolinda R, Joshna T, Susie K, Javan N, Thoibahenba S. A study of pain perception during the different phases of menstrual cycle. J Evol Med Dent Sci 2012;1(6):1150-53.
9. Maite V, Manlio F, Márquez. Age, body mass index and menstrual cycle influence young women's heart rate variability. Clin Autonom Res 2005;15(4):292-298.

10. Ishizawa T, Yoshiuchi K, Takimoto Y, YamamotoY, Akabayashi A. Heart rate and blood pressurevariability and baroreflex sensitivity in patients with anorexia nervosa. Psychosom Med 2008; 70:695–700.
11. Petretta M, Bonaduce D, Scalfi L, de Filippo E. Heart rate variability as a measure of autonomic nervous system function in anorexia nervosa. Clin Cardiol 1997; 20:219–224.
12. Hapidou EG, De Catanzaro D. Sensitivity to cold pressor pain in dysmenorrheic and non-dysmenorrheic women as a function of menstrual cycle phase. Pain 1988; 34:277–283.
13. Berglund LA, Derendorf H, Simpkins JW. Desensitization of brain opiate receptor mechanisms by gonadal steroid treatments that stimulate luteinizing hormone secretion. Endocrinology 1988; 122:2718–26.