To Evaluate the Involvement of Autonomic Nervous System during Pre and Post Menstrual Phases in Young Women

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Abstracts: Background: During reproductive life, Women undergo many types of behavioural and hormonal changes, which influence various functions of body. ANS provides physiological adaptive background for these changes. The main aim of this study is to carry out autonomic function tests during various phases of menstrual cycle. Method: Different Methods were used to evaluate sympathetic and Parasympathetic activity. This study was carried out in two different phases of menstrual cycle viz. premenstrual phase (late luteal phase-LL) and post menstrual phase (early follicular phase –EF). Results: The autonomic function tests and heart rate variables were recorded and data was tabulated for Statistical evaluation with student paired "t" test. $P < 0.05$ was considered as statistically significant. The tests for sympathetic activity were compared during pre and post menstrual phases. It was observed that pulse rate, blood pressure and cold pressor test were statistically more significant ($p<0.01$), while orthostatic variation in arterial blood pressure was statistically significant ($p<0.05$) in premenstrual phase as compared to post menstrual phase of menstrual cycle. For parasympathetic activity it was observed that heart rate response, expiratory: inspiratory ratio and valsalva ratio were statistically not significant ($p>0.05$) in both pre and post menstrual phases of menstrual cycle. Conclusion: In this study the responses to various sympathetic tests were significantly altered in premenstrual phase as compare to that of postmenstrual phase, reflecting the significant increase in the sympathetic activity. These changes may be due to gonadal steroids imbalance during post menstrual phase (EF) and premenstrual phase (LL) of menstrual cycle which in turn affects HPA axis and ANS significantly. Significant increased sympathetic activity responses indicate an augmented stress system. [Chand K et al NJIRM 2012; 3(2) : 26-30]

Key words: ANS- Autonomic nervous system , LL-Late luteal phase, EF-Early follicular phase, HPA - Hypothalamo pituitary adrenal, Sympathetic activity

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Introduction: Physical, **P**sychological, behavioural and hormonal changes occur in women especially during reproductive life. These changes might be due to one or more variables like hormonal levels, physical as well as mental stress, personality characteristics, genetic determinants and social factors which may contribute directly or indirectly. Most often the cumulative physiological effect of stress causes disruption of the natural rhythms and balancing mechanism of female hormones. Autonomic nervous system (ANS) provides the physiological background for the perceived changes. The peripheral nerves mediate the autonomic control of the heart rate and the blood pressure and their influence on the uterus depends on the oestrogen and progesterone secretions [1]. During the premenopausal period and early menopause, there is a progressive hormonal imbalance which might help to explain the characteristics "hot flushes" and so called climacteric depression [2]. Cumulative physiological effect of stress causes disruption of the natural rhythms and balancing mechanism of female hormones, there by compromising overall health as well as sexual and reproductive health, manifesting as problems ranging from depression to panic disorders. Earlier study reports document the autonomic changes in the reproductive period with respect to the menstrual cycle [3,4,5] and pregnancy [6]

Material and Methods: The study was approved by Ethical Committee. Present study was conducted in the Department of Physiology, Kakatiya Medical College, Warangal. The study of autonomic function

tests was carried out in two different phases of menstrual cycle. For the study, 50 healthy volunteers, aged between 18-25 years were selected Informed consent was obtained from each subject. The exclusion criteria were: Volunteers with irregular menses, Volunteers with menorrhagia and oligomenorrhoea.

All the volunteers were assessed for autonomic function tests during premenstrual phase i.e. around 25^{th} -26^{th} day of menstrual cycle and during postmenstrual phase i.e. on 6^{th} -7^{th} day of menstruation.

Physical parameters noted in each volunteer were: Age in years. Weight in Kgs. Blood pressure was recorded with sphygmomanometer by Auscultatory method. Electrocardiogram (ECG-CARDIART 108 T-British physical laboratories India limited) recordings were carried out in Lead II. All tests were carried out in the morning and afternoon hours with the consent of volunteers. After giving rest for 5 minutes, the following parameters were recorded.

Following Autonomic Function Tests were done using standard method[7]

Tests for sympathetic function:

1. Pulse rate (per minute) by Palpatory method.
2. Arterial blood pressure (mm of Hg) recording by Auscultatory method.
3. Orthostatic variation in arterial blood pressure:
4. Cold pressor test:

Tests for parasympathetic functions:

1. Heart rate response:
2. Expiratory: Inspiratory ratio: (E: I ratio):
3. Valsalva ratio:

Results: Statistical analysis. It was done by student paired "t" test. $P < 0.05$ was considered as statistically significant.

OBSERVATIONS

The result of parameters reflecting sympathetic activity: In Table No.1, the autonomic function tests for sympathetic activity were compared during pre and post menstrual phases. It was observed that pulse rate, blood pressure and cold pressor test were statistically more significant ($p<0.01$), while orthostatic variation in arterial blood pressure was statistically significant ($p<0.05$) in premenstrual phase as compared to post menstrual phase of menstrual cycle.

The result of parameters reflecting parasympathetic activity, In Table No.2, the autonomic function tests for parasympathetic activity were compared during pre and post menstrual phases. It was observed that heart rate response, expiratory: inspiratory ratio and valsalva ratio were statistically not significant ($p>0.05$) in both pre and post menstrual phases of menstrual cycle.

Discussion

In the present study the premenstrual phase was taken as late luteal (LL) phase of menstrual cycle and postmenstrual phase as an early follicular (EL) phase of menstrual cycle. The hormonal changes to regulate the menstrual cycle were associated with physiological and psychological changes in women.

In the present study, responses to pulse rate, orthostatic variation in arterial blood pressure and cold pressor test were significantly ($p<0.05$) altered in premenstrual phase as compared to that of postmenstrual phase, reflecting a significant increase in sympathetic activity.

This can be explained on the basis that-female reproductive steroids are modulators of HPA axis, which in association with ANS, form the stress system which regulates homeostatic mechanisms of the body. This HPA axis that is CRH induced proopiomelanocortin peptide inhibits GnRH secretion from hypothalamus which in turn affects the ovarian estrogen and progesterone levels[8]. The gonadal hormones fluctuation during the menstrual cycle is associated with significant changes in multiple neurohumoral homeostatic mechanisms of the body[9].

Estrogen increases sympathetic baroreflex sensitivity and also has a prolonged stimulatory action on CRH gene promoter and central non adrenergic system which indicates changes in sympathetic activity responses significantly more during premenstrual (LL) phase than postmenstrual (EF) phase[10].

The changes in sympathetic activity might be due to one or more variables like hormonal levels (changing influence of ovarian steroids in different

Table No.1: Comparison of autonomic functions in two different phases
The result of parameters reflecting sympathetic activity

	Premenstrual (LL)Phase (n=50)	Postmenstrual (EL)phase (n=50)	'Z' value	'p' value	Result
	Mean ±SD	Mean ±SD			
Pulse rate (per min)	86.12 ± 4.33	77.0 ± 3.92	11.04	p<0.01	More significant
Supine					
SBP(mm Hg)	113.32 ± 4.59	106.2 ± 4.84	7.55	p<0.01	More significant
DBP(mm Hg)	71.2 ±4.27	65.32 ± 4.67	6.35	p<0.01	
Standing					
SBP(mm Hg)	109.96 ± 5.11	104.28 ± 4.83	5.74	p<0.01	More significant
DBP(mm Hg	79.46 ± 4.39	73.12 ± 4.02	7.53	p<0.01	
Orthostatic variation in arterial blood pressure					
SBP(mm Hg)	-2.18 ± 0.66	-1.72 ± 0.47	2.01	p<0.05	Significant
DBP(mm Hg)	8.26 ± 1.01	7.8 ± 1.12	1.98	p<0.05	Significant
Cold Pressor test					
SBP(mm Hg)	123.24 ± 4.16	115.64 ± 4.25	9.04	p<0.01	More Significant
DBP(mm Hg)	90.1 ±3.94	80.68 ± 2.67	13.98	p<0.01	

In Table No.1, the autonomic function tests for sympathetic activity were compared during pre and post menstrual phases. It was observed that pulse rate, blood pressure and cold pressor test were statistically more significant (p<0.01), while orthostatic variation in arterial blood pressure was statistically significant (p<0.05) in premenstrual phase as compared to post menstrual phase of menstrual cycle.

Table No.2: Comparison of autonomic functions in two different phases:
The result of parameters reflecting parasympathetic activity

	Premenstrual (LL)Phase (n=50)	Postmenstrual (EL)phase (n=50)	'Z' value	'p' value	Result
	Mean ±SD	Mean ±SD			
Heart Rate Response	16.46 ± 4.92	16.62 ± 5.31	0.16	p>0.05	Not significant
Expiratory:Inspiratory Ratio	1.43 ± 0.23	1.40 ± 0.29	0.45	p>0.05	Not significant
Valsalva Ratio	1.15 ± 0.065	1.16 ± 0.08	1.16	p>0.05	Not significant

In Table No.2, the autonomic function tests for parasympathetic activity were compared during pre and post menstrual phases. It was observed that heart rate response, expiratory: inspiratory ratio and valsalva ratio were statistically not significant (p>0.05) in both pre and post menstrual phases of menstrual cycle.

phases), personality characteristics, genetic determinants and social factors which may contribute directly or indirectly.[11]

A large number of studies in relation to the menstrual cycle were carried out by earlier workers but no consistent picture could be emerged.[12.13, 14,15,16,17,18.]

It was observed that some studies which used multiple variables like the present study also showed an increased sympathetic activity in premenstrual phase.

An excellent review of different studies of physical and psychological changes throughout the menstrual cycle in three forms, namely the behavioural, autonomic and cortical was done[14].

It was concluded that changes occurring in premenstrual phase were sympathetic alike[19] and was also revealed that tension and anxiety were reliably associated with an autonomic arousal[20].

It was observed that there were significant responses to orthostatic variation in arterial blood pressure, cold pressor test in the premenstrual period indicating an increased sympathetic activity with no change in parasympathetic activity[12].

It was proved that there was a prevalence of 60.7% for autonomic reaction in the premenstrual period[4].

Some studies used different variables for testing the autonomic functions than that of the present study but the results were consistent in both the studies, though the autonomic variables studied in present study were different from other studies.

The autonomic variables like sublingual temperature, diastolic blood pressure, palmar and volar conductance and salivary output were studied. It was observed that during menstrual, follicular and ovulatory phases responses were higher, showing a parasympathetic dominance, whereas during luteal phase responses were lowest suggesting a sympathetic dominance[22].

In contrast to present study, some studies found no differences in autonomic reactivity in different phases of menstrual cycle. [23, 24, 25.]

The subjects were tested premenstrualy and postmenstrualy for their autonomic reactivity during stress (cold pressor test, mental arithmetic) and for their acquisition of conditioned electro-dermal responses and found no difference in the two phases[25]. It was also claimed that no consistent cyclic variation of autonomic variables occurred in women and this discrepancy between results may be because of the difference in the variables tested and the methods employed for determining the sympathetic and parasympathetic activities. [23,24.]

It was found that there were no changes in autonomic reactivity in the premenstrual phase[19,22,26] this difference in result may be because of a single autonomic variable like only heart rate or skin potential or skin conductance was tested in other studies, while in the present study, multiple variables were tested.

Conclusion: Female reproductive steroids are modulators of HPA axis, in association with ANS form the stress system which regulates homeostatic mechanisms of the body. This HPA axis that is CRH induced proopiomelanocortin peptide inhibits GnRH secretion from hypothalamus which in turn affects the ovarian estrogen and progesterone levels.

The gonadal hormones fluctuation during the menstrual cycle is associated with significant changes in multiple neurohumoral homeostatic mechanisms of the body.

Estrogen increases sympathetic baroreflex sensitivity and also has a prolonged stimulatory action on CRH gene promoter and central non adrenergic system which indicates changes in sympathetic activity responses significantly more during premenstrual (LL) phase than postmenstrual (EF) phase.

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