

## **Sympathetic nerve function status and their relationships with ovarian hormones in healthy young women**

**Latifa Afrin Dill Naher<sup>1</sup>, Noorzahan Begum<sup>2</sup>, Sultana Ferdousi<sup>3</sup>**

### **Abstract**

**Background:** Alteration of sympathetic nerve activity during different phases of menstrual cycle in healthy young women, has been found related with phasic fluctuation of ovarian hormones. **Objective:** To observe relation of sympathetic nerve function status with estrogen and progesterone during follicular and luteal phases of menstrual cycle in healthy young women. **Methods:** This cross sectional study was carried out in the Department of physiology of BSMMU, Dhaka from 1<sup>st</sup> January to 31<sup>st</sup> December 2007. Thirty apparently healthy unmarried women with age 20 to 30 years were selected. Sympathetic nerve function was evaluated by 2 reflex tests, orthostatic test and sustained handgrip, during the three phases of menstrual cycle. Serum estrogen and progesterone were measured during follicular and luteal phases. Data were analyzed by One way ANOVA, an unpaired t test and Pearson's correlation coefficient where applicable. **Results:** There were no significant differences among sympathetic nerve function parameters during three phases of menstrual cycle. Serum estrogen and progesterone showed non significant ( $p>0.05$ ) relationship with sympathetic nerve function parameters. **Conclusion:** From this study it may be concluded that sympathetic nerve activity remains unaltered despite fluctuation of ovarian hormones in different phases of menstrual cycle in healthy young women.

**Key Words:** Ovarian hormone, sympathetic nerve activity.

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### **Introduction**

**D**uring the childbearing age women have reduced risk of cardiovascular diseases than man<sup>1</sup>. Healthy young women having normal menstrual cycle is characterized by increased level of oestrogen secretion before ovulation followed by a sharp fall then secondary phase of secretion in the luteal phase. But during luteal phase both estrogen in moderate and progesterone hormone remain in high concentration<sup>2</sup>. Very Few researches have been carried out on healthy young women to find out the relationship of sympathetic nerve activity and

ovarian hormones during different phases of menstrual cycle, where changes in ovarian hormone occur to a great extent. Some investigators observed increased sympathetic activity during luteal phase of menstrual cycle<sup>1,5</sup>. However, other investigators did not observe any change in sympathetic nerve function during luteal phase<sup>6</sup>. Some researchers observed greater sympathetic baroreflex sensitivity during mid luteal (high hormone) phase compared with the menstrual (low hormone) phase of a normal menstrual cycle<sup>7</sup>. Because of this conflicting reports, this study aimed to observe sympathetic

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nerve activity during different phases of menstrual cycle and their relationships with ovarian hormones in healthy young women.

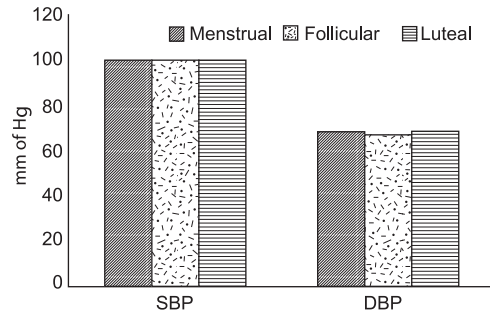
### Methods

This cross sectional study was carried out in the Department of physiology of BSMMU, Dhaka from 1<sup>st</sup> January to 31<sup>st</sup> December 2007. A total number of thirty apparently healthy unmarried women with age ranged from 20 to 30 years were enrolled. They were studied during the menstrual, follicular and luteal phases of menstrual cycle. All the subjects were having regular menstrual cycle and were free from Diabetes mellitus, renal failure, BMI > 22.9 kg/m<sup>2</sup>, menstrual abnormalities, any acute or chronic illness or any medication affecting CNS. The study Protocol was approved by the ethical committee of the department of Physiology BSMMU. The aim and objectives of the study were explained to the subjects in details and then written informed consent was taken. Resting SBP and DBP were measured during each 3 phases of menstrual cycle. Again, sympathetic nerve function was evaluated by 2 simple non invasive conventional autonomic nerve function tests such as fall in systolic blood pressure after standing and rise in diastolic blood pressure during sustained handgrip in three phases of a menstrual cycle. Three ml venous blood was collected to measure serum estrogen and progesterone level by during follicular and luteal phases of menstrual cycle. Hormone was not measured during menstrual phase as its secretion was negligible in quantity. Data was expressed as mean  $\pm$ SD. Data were analyzed by One way ANOVA, un paired t test and Pearson's correlation coefficient where applicable. The statistical analysis was done by SPSS program version-11.5. "p" value <0.05 was considered as significant.

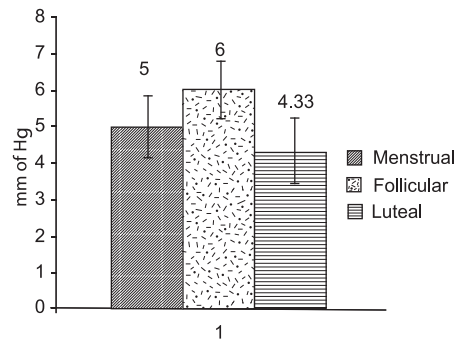
### Results

All the mean values of SBP and DBP in menstrual, follicular, luteal phase were not significantly different. (Figure 1). Mean  $\pm$ SD fall in systolic blood pressure after standing and rise

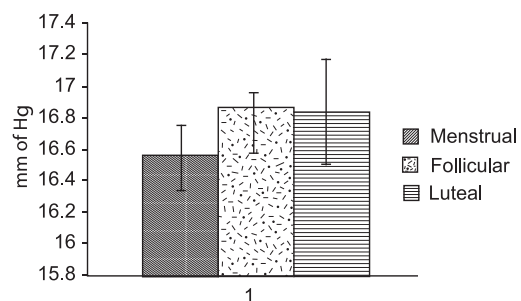
in DBP after sustained handgrip in all groups were almost similar and no statistical ( $p > 0.05$ ) significant differences were observed. (Figure 2&3)



**Figure 1:** Resting SBP and DBP during 3 phases of menstrual cycle. No significant difference among the phases were noted.



**Figure 2:** Fall in SBP after standing from lying during 3 phases of menstrual cycle. No significant difference among the phases were noted.



**Figure 3:** Rise of DBP during sustained handgrip during 3 phases of menstrual cycle. No significant difference among the phases were noted.

**Table I :** Relationship of serum estrogen level with sympathetic nerve function parameters in different groups (n=60)

Parameters	Follicular		luteal	
	r	p	r	p
Fall in systolic blood pressure after standing (mm of Hg)	0.033	0.864 <sup>ns</sup>	-0.22	0.243
Rise in diastolic blood pressure after sustained handgrip (mm of Hg)	-0.302	0.105 <sup>ns</sup>	0.264	0.159

**Table-II :** Relationship of serum progesterone level with sympathetic nerve function parameters in different groups (n=60)

Parameters	Follicular		Luteal	
	r	p	r	p
Fall in systolic blood pressure after standing (mm of Hg)	-0.253	0.177 <sup>ns</sup>	-0.019	0.920
Increase in diastolic blood pressure after sustained handgrip (mm of Hg)	-0.027	0.888 <sup>ns</sup>	0.049	0.796

Fall in systolic blood pressure after standing from lying position was positively correlated with serum estrogen in follicular but negatively correlated in luteal whereas negatively correlated with serum progesterone level in both follicular and luteal phase. The increase in diastolic blood pressure after sustained handgrip was negatively correlated with serum estrogen in follicular but positively correlated in luteal but with progesterone it was negatively correlated in follicular and positively correlated in luteal phase. (Table I & II). However all these correlations were statistically not significant ( $p > 0.05$ ).

### Discussion

In this study, high level of serum estrogen were observed in both follicular and luteal phases of menstrual cycle. Values of estrogen and progesterone were published in our previous article<sup>8</sup>. These results are consistent with the results observed by Edwards et al.<sup>9</sup> and Tanaka

et al.<sup>10</sup>. Again serum progesterone level during luteal phase was significantly higher than follicular phase. Similar results had been observed by Sato et al.<sup>1</sup>, Edwards et al.<sup>9</sup> and Tanaka et al.<sup>10</sup>.

Again, resting systolic and diastolic blood pressures among the three phases of menstrual cycle of the present series of premenopausal women were within normal ranges and no significant differences have been observed among the phases that indicate no altered sympathetic nerve activity during these phases of menstrual cycle. Greenberg et al.<sup>11</sup>, Hirshoren et al.<sup>12</sup> and Pai et al.<sup>13</sup> also have demonstrated similar findings. Again, Sato et al.<sup>1</sup> observed similar results when compared SBP and DBP during follicular and luteal phases of menstrual cycle. However, Mehta and Chakrabarty<sup>5</sup> demonstrated significantly higher values of systolic blood pressure during luteal phase than other phases of menstrual cycle but there was no change in diastolic blood pressures. Again,

another group of investigators observed decreased values of both systolic and diastolic blood pressure during luteal phase of menstrual cycle<sup>9</sup>.

In our study values of fall in systolic blood pressure after standing and rise in diastolic blood pressure during sustained handgrip were not significantly different among the three phases of menstrual cycle. This result is in consistent with the findings observed by Leicht, Hirning and Allen<sup>6</sup>, but they have used power spectral analysis of HRV to detect sympathetic nerve activity. However, some investigators have got increased sympathetic nerve activity during luteal phase in comparison to follicular phase by using power spectral analysis of HRV<sup>1,4</sup>. Again, Mehta and Chakrabarty<sup>5</sup> have observed increased sympathetic activity during luteal phase than other phases of menstrual cycle.

In this study, observed relationships between serum estrogen and sympathetic nerve function parameters were not statistically significant in both follicular and luteal phases of menstrual cycle. Similar findings were obtained by tamaka matsumoto<sup>14</sup> who used HRV on eumenorrheic women having no premenstrual symptoms. However, in our study we did not consider premenstrual symptoms while selecting subjects. Again Leicht, Hirning and Allen demonstrated significant relationship between serum estrogen and HRV at ovulation<sup>6</sup>.

In this group of women we did not observe significant relationship between progesterone and sympathetic nerve function parameters. However, Minson et. al. found that sympathetic baroreflex sensitivity may be enhanced by estrogen but progesterone may antagonize this effect in young women<sup>2</sup>.

The under lying biomechanisms of estrogen and progesterone on sympathetic nerve function remains enigmatic. Heesch, Rogers howed that

progesterone reduces sympathetic baroreflex sensitivity<sup>15</sup> but in 1998 He X-R, Wang, Crofton<sup>16</sup> observed in animal studies that estrogen enhances sympathetic baroreflex sensitivity. Similar observations also demonstrated by Christopher et. al. in 2000<sup>2</sup> who observed that estrogen augment sympathetic baroreflex sensitivity but progesterone antagonizes this activity in young women. Heesch, Rogers in 1995<sup>15</sup>; Heesch, Folly in 2001 suggested that progesterone in high concentration potentiate the GABA mediated baroreflex symphatho-inhibition within RVLM<sup>17-18</sup>.

### Conclusion

From this study it may be concluded that sympathetic nerve activity may not change despite fluctuation of ovarian hormones in different phases of menstrual cycle in healthy young women.

**Conflict of interest:** None

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