

Original Research

Evaluation of heart rate variability in different phases of menstrual cycle

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ABSTRACT:

Background: Heart rate variability analysis has been extensively used as a tool to examine the underlying mechanisms involved in autonomic control of the heart. The present study was conducted to determine heart rate variability in menstrual cycle. **Materials & Methods:** The present study was conducted on 110 females age ranged 20-40 years. Two main frequency components that is the low frequency (LF) components and the high frequency (HF) components were measured and LF/HF ratio was analyzed. To quantify heart rate, the analog ECG signal was obtained using lead II to obtain a QRS complex of sufficient amplitude and stable base line. **Results:** The mean LF level in menstrual phase was 42.3, in follicular phase was 47.5 and in luteal phase was 61.7. The difference was significant ($P < 0.05$). The mean HF level in menstrual phase was 50.2, in follicular phase was 61.3 and in luteal phase was 43.5. The difference was significant ($P < 0.05$). LF/HF level in menstrual phase was 0.72, in follicular phase was 1.03 and in luteal phase was 1.82. The difference was significant ($P < 0.05$). **Conclusion:** Authors found sympathetic nervous activity in the luteal phase is greater than in the follicular phase whereas parasympathetic nervous activity is predominant in the follicular phase.

Key words: Follicular phase, Heart rate variability, Sympathetic nervous activity.

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INTRODUCTION

The menstrual cycle (MC) is characterized by an intense hormonal activity, mainly driven by estrogen and progesterone. During the menses, those hormones are usually with reduced levels, but it gradually increases its levels until the follicular phases, thus reaching ovulation. The MC on average lasts 28 days, but there is considerable variation in the duration between healthy women ranging between 24 and 35 days. The follicular phase is the period from the first day of menstruation and lasts up to day 14 (end of ovulation), with higher levels of estrogen. Follicle stimulating hormone (FSH) and luteinizing hormone to promote the rapid growth and follicular rupture. The luteal phase begins at the end of ovulation until the beginning of another menstrual flow.

Heart rate variability (HRV) analysis has been extensively used as a tool to examine the underlying mechanisms involved in autonomic control of the heart. The sympathetic and parasympathetic branches of the autonomic nervous system (ANS) regulate the activity of the sinoatrial node, the cardiac pacemaker. The beat-to-beat variation in heart rate therefore reflects the time varying influence of the ANS and its components, on cardiac function. HRV analysis can assess the overall cardiac health and the balance between sympathetic and parasympathetic regulation on cardiac activity. Gonadotropic hormones are known to affect this balance. This method has proved to be of great clinical usefulness in studying several pathological conditions due to the hormonal imbalance in women. The present

study was conducted to determine heart rate variability in menstrual cycle.

MATERIALS & METHODS

The present study was conducted in the department of Physiology. It comprised of 110 females age ranged 20-40 years. All subjects were informed regarding the study and written consent was obtained.

Data such as name, age etc. was recorded. The ECG recordings were taken during the 3 phases - menstrual

phase, follicular phase and luteal phase of menstrual cycle by means of HRV power spectral analysis. Two main frequency components that is the low frequency (LF) components and the high frequency (HF) components were measured and LF/HF ratio was analyzed. To quantify heart rate, the analog ECG signal was obtained using lead II to obtain a QRS complex of sufficient amplitude and stable base line. The results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I LF analysis in different phases of menstrual cycle

Phase	Mean	P value
Menstrual	42.3	0.01
Follicular	47.5	
Luteal	61.7	

Table I shows that mean LF level in menstrual phase was 42.3, in follicular phase was 47.5 and in luteal phase was 61.7. The difference was significant (P< 0.05).

Table II HF analysis in different phases of menstrual cycle

Phase	Mean	P value
Menstrual	50.2	0.02
Follicular	61.3	
Luteal	43.5	

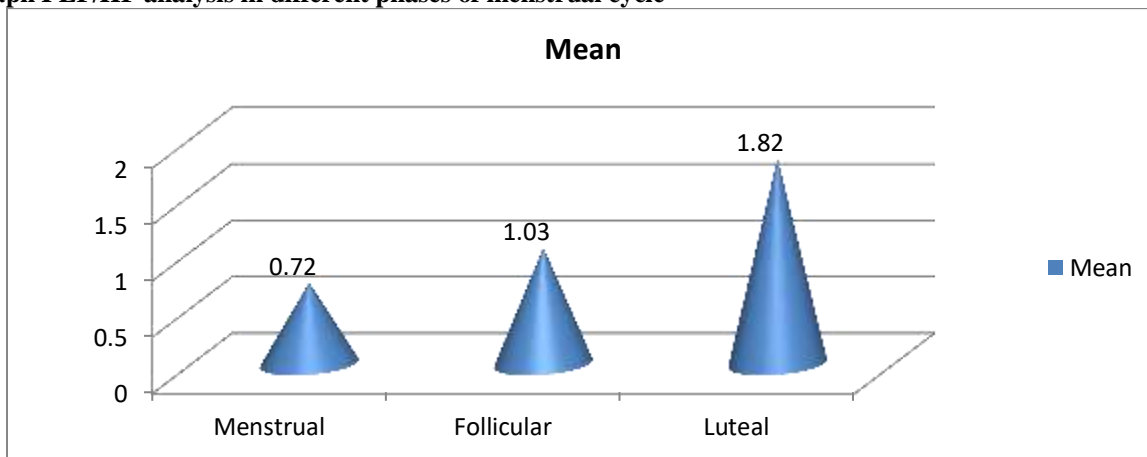
Table II shows that mean HF level in menstrual phase was 50.2, in follicular phase was 61.3 and in luteal phase was 43.5. The difference was significant (P< 0.05).

Table III LF/HF analysis in different phases of menstrual cycle

Phase	Mean	P value
Menstrual	0.72	0.01
Follicular	1.03	
Luteal	1.82	

Table III, graph I shows that LF/HF level in menstrual phase was 0.72, in follicular phase was 1.03 and in luteal phase was 1.82. The difference was significant (P< 0.05).

Graph I LF/HF analysis in different phases of menstrual cycle



DISCUSSION

The heart rate variability (HRV) has been shown as a powerful tool to demonstrate the autonomic nervous system activity noninvasively and has been corroborated as a valuable tool for cardiovascular risk assessment. Both time and frequency domains have high correlations with sympathetic and parasympathetic chains, precisely measuring the autonomic activity through the cardiac baroreflex activity. The nonlinear analysis is recently being under investigations for its applications regarding the autonomic activity.⁶

The two common forms of HRV analysis are often designated as time-and frequency-domain measures. Time domain measures are the means and standard deviations of R-R intervals recorded by the continuous ECG, where NN (normal-to-normal) intervals represent all the R-R intervals. One of the variables of time domain measures the SDNN, which reflects all the cyclic components responsible for variability in the period of the recording. The SDNN estimates overall HRV.⁶ A decrease in SDNN has been associated with sudden cardiac death.⁷ Spectral analysis of a series of successive R-R intervals provides the frequency domain analysis. This technique separates the heart rate spectrum into various components and quantifies sympathetic and vagal influences on the heart. The high frequency (HF) generally represents parasympathetic activity and is therefore generally considered to be a marker of vagal activity whereas, the low frequency (LF) is influenced by both sympathetic and parasympathetic activity.⁸ The ratio of LF:HF represents the balance of parasympathetic and sympathetic activity. The present study was conducted to determine heart rate variability in menstrual cycle.

In present study, we included 110 females age ranged 20-40 years old. The mean LF level in menstrual phase was 42.3, in follicular phase was 47.5 and in luteal phase was 61.7. The mean HF level in menstrual phase was 50.2, in follicular phase was 61.3 and in luteal phase was 43.5. Teixeira et al⁹ found that mean base line levels during the menstrual, follicular and luteal phase was 40.4 ± 16 , 46.2 ± 14 and 60.8 ± 73 for LF component, 52.15 ± 10.61 , 60.96 ± 14.58 and 42.41 ± 17.92 for HF component and 0.68 ± 0.54 , 1.08 ± 0.36 and 1.92 ± 1.05 for LF/HF ratio respectively. LF component was significantly higher.

We found that LF/HF level in menstrual phase was 0.72, in follicular phase was 1.03 and in luteal phase was 1.82. Vishrutha et al¹⁰ in their study, 19 women had participated, reporting their physical activity status and menstrual cycle period. Spectral analysis of HRV was used to calculate low-frequency or LF (0.04–0.15 Hz) and high frequency or HF (0.15–0.4 Hz). Normalized LF and HF components of R–R variability were considered, respectively, as markers of cardiac sympathetic and parasympathetic modulation, and the

ratio between them (LF/HF) was considered as an index of the autonomic modulation of the heart. For the determination of the follicular and luteal phases, the monitoring for 5 months was used to characterize the regularity in days the menstrual cycle. As expected, an increased sympathetic and decreased parasympathetic balance was found in the luteal phase when compared to the follicular phase, as shown by increased low-frequency (LF) domains and, decreased RMSSD and HF indexes ($P < 0.05$).

Several studies already compared the HRV in different menstrual cycle phases, but with methodological differences. Most investigators suggested a modulated vegetative control based on some selected HRV results whereas one author did not find any HRV modulations in the time and the frequency domain in course of the menstrual cycle.^{11,12}

CONCLUSION

Authors found sympathetic nervous activity in the luteal phase is greater than in the follicular phase whereas parasympathetic nervous activity is predominant in the follicular phase.

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