ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Heartrate Variability across Different Phases Menstrual Cycle in Adolescent Females.

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ABSTRACT

Influence of menstrual cycle on heart rate variability have been studied by several workers with inconsistent results .In most of the previously done studies heart rate variability was measured across the proliferative and secretory phase of menstrual cycle and the observed results were attributed to the changes in the hormonal levels .However , heart rate variability during menstrual phase have not been measured in most of the studies . There may be some change in the resting autonomic tone owing to the hormonal and hemodynamic changes at this phase. The aim of this study was to assess the heart rate variability across the three phases of menstrual cycle in adolescent females with normal menstrual cycle. Fifteen adolescent females of age group 17-19 years ,with normal BMI and eumennorhic cycle were included in this study .Heart rate variability was measured across the three phases of menstrual cycle using RMS polyrite D. Blood pressure was measured using non invasive blood pressure apparatus .The Heart rate variability parameters namely LF,HF and LF/HF ratio measured across the three phases of menstrual cycle was compared**.** There was an increase in the diastolic blood pressure and LF values in the menstrual phase. However, it was not statistically significant.

Keywords: Heart Rate Variability, Menstrual Phase, Diastolic Blood Pressure.

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ISSN: 0975-8585

INTRODUCTION

Heart ratevariabilityrefers to the periodic and non -periodic variations in the Instantaneous Heart rate and R-R intervals .Sinus node is the pacemaker of the heart and it controls the heart rate. The parasympathetic branch of the autonomic nervous system is mainly distributed to the sinus node and atrioventricular node .Hence , the vagal branch of the autonomic nervous system is mainly concerned with the regulation of heart rate [1]. Cardiovascular disorders are associated with heart rate fluctuation . This fluctuation in turn alters the heart rate and R-R intervals. Heart rate variability can be used for assessing the extent to which the heart rate is influenced by both the branches of the autonomic nervous system .

TheMenstrual cycle is a basic physiological process which affects the bodilyfunctions of the women because of the fluctuation in the sex hormone levels across the different phases .Menstrual cycle is divided in to three phases namely proliferative, secretoryand the menstrual phase . The fluctuation in the sex hormone levels may influences the cardiovascular regulation across the different phases .However , controversial results have been reported in studies done so far . In a study done by Sato et al it was observed that there is an increase in the LF components accompanied or unaccompanied by a decrease in the HF component in HRV during luteal phase as compared to the follicular phase concluding that there is an increase in the sympathetic activity which may be due to the fluctuation in the ovarian hormone[2].However, in some studies despite of the variation in the female sex hormone variation in spectral properties in HRV was not reported [3].Increased parasympathetic activity and decreased sympathetic activity in luteal phase was reported byPrinci et al [4].Some studies has reported that Menstrual cycle was the least important factor affecting HRV changes relative to age and body mass index [5].

Controversies exist as to whether there is any variation in HRV indices across the different phase of the menstrual cycle and the extent to which HRV is influenced by the hormonal variation across different phases of menstrual cycle .This have always been a subject of interest. Moreover , Variation in HRV has been measured in most of the studies only during proliferative and secretory phase .In this study , the Heart Rate Variability has been measured across the three phases of menstrual cycle by comparing the mean values of LF,HF and LF/HF ratio across the three phases .

MATERIALS AND METHODOLOGY

This study has been approved by the institutional ethical committee of Sree Balaji Medical College& Hospital . After obtaining written informed consent , Fifteen healthy female volunteers of mean age 18 ± 0.9 years , with normal Body Mass Index averaging 21.04 ± 1.67 Kg/ m^2 with regular menstrual cycle were recruited for this study.Subjects taking any medications, that can alter the hormonal status and HRV parameters, regularly exercising subjects(if exercising, asked to stop for 3 months) ,subjects suffering from any other illness were excluded.

ISSN: 0975-8585

Experimental Protocol

Subjects were instructed to report to the laboratory at all the three phases of the menstrual cycle, namely,menstrual phase (1-5 days), proliferative phase (9-12 day s), secretory phase (19- 22nd day) [6]. Heart Rate Variability recording was done on all the three phases of the menstrual cycle using RMS Polyrite D. To avoid diurnal variation It was ensured that the recording was done at the same time between 8-11 A.M. Pretest preparations were over night fasting for 12 hours , Subjects were instructed to avoid any caffeinated products for 16hrs prior to testing. The room temperature was maintained between 22˚C -24˚C.

Recording was done in supine position. The subjects were asked to relax and close the eyes. GS1, GS2 and ground electrodes were placed on the right loin, left loin and on the right arm respectively. These leads are connected to the Polyrite, HRV icon is chosen in the subject details entered and acquisition is done. After ensuring that there is no artifact recording mode is selected and recording wasdone for 20mins.Blood pressure was measured along with HRV parameters across the three phases of menstrual cycle by using non invasive blood pressure apparatus .

Data Analysis

Data's were analyzed using RMS software version 2.5.2 at a sampling rate of 200 samples/sec. Frequency domain measures were determined by using spectral analysis using fast fourier transformation. The frequency components namely LF(Low Frequency 0.04-0.15 HZ)reflecting sympathetic and parasympathetic modulation and HF (High Frequency 0.15- 0.80 HZ) reflecting parasympathetic modulation and LF/HF ratio used as sympathovagal balance were taken for statistical analysis.

Statistical Analysis

The baseline Data 's were expressed as Mean±SD. The frequency domain parameters measured in normalized units across the three phases were represented as Mean±SD. Statistical analysis was done to compare the values of the frequency domain parameters across the three phases by using one way ANOVA . p Value less than 0.05 was considered as significant.

RESULTS

Table 1: The Baseline characteristics of the female subjects.

Parameters	Values
Age in years	18 ± 0.9
Height in Cms	163.3 ± 5.5
Weight in Kg	56.3 ± 7.02
BMI in Kg/m^2	21.04 ± 1.67

ISSN: 0975-8585

Table 2: compares the mean of the LF, HF values and LF/HF ratio and the blood pressure across the three phases of menstrual cycle, namely proliferative ,secretory and menstrual phase.

PHASES	LF nu	HF nu	LF/HF	SYSTOLIC BP (mm Hg)	DIASTOLIC BP (mm Hg)
Menstrual	70.9± 9.6	29.7 ± 9.6	2.6 ± 1.0	124±1.2	86 ± 0.3
Proliferative	67.6 ± 5.5	32.3 ± 5.5	2.2 ± 0.5	118 ± 1.0	82 ±1.6
Secretory	68.6 ± 5.1	31.3 ±5.2	2.2 ± 0.6	120 ± 1.2	83 ± 0.3

Table 3: correlation of body mass index with HRV parameters .

HRV parameters	Height (cms)	Weight (Kg)	BMI
LF nu	r = .249 p=.508	r = .502 p= .169	r = .612 p= .080
HF nu	r = .249 p= .518	r = .502 p=.169	r = -0.612 p=.080
LF/HF ratio	r = .135 p=.730	r = .395 p= .293	r = .539 p= .134

RESULTS

Table 1 –shows the base line characteristics, Table 2 – compares the HRV parameters across the three phases of menstrual cycle. It was observed that there was an increase in LFvalues in the menstrual phase when compared to other phases. The diastolic blood pressure was also more in menstrual phase when compared to other phases. However, no statistical significance was observed. Table 3- Correlates the body mass index with HRV parameters. A slightly positive correlation was observed between LF and BMI.

DISCUSSION

This study included fifteen female subjects with normal BMI and of mean age 18 ± 0.9yrs with eumennorrhic cycle .Heart rate variability was measured across the three phases of menstrual cycle namely menstrual phase (1-5 days), proliferative phase (9-12 days), secretory phase (19- 22nd day) [6].

It was observed that the mean value of low frequency (LF) which is a measure of both sympathetic and parasympathetic activity was higher during menstrual phase. High frequency (HF) value is an indicator of parasympathetic activity it was lower in menstrual phase . An increase in LF/HF ratio during the menstrual phase was observed indicating that there is a tilt in sympathovagal balance towards sympathetic overactivity during this phase .

A higher sympathetic activity during secretory phase when compared to the proliferative phase of menstrual cycle have been reported by Christina et al . In our study , the mean LF value was higher in secretory phase when compared to proliferative phase but it was not statistically significant .However , the LF value in menstrual phase was highest when compared to the proliferative and secretory phase .

ISSN: 0975-8585

Regulation of autonomic tone is mainly a function of baroreceptor, However , It has been reported by guasti et al that the baroreceptor function seems to be scarcely influenced by the two phases of menstrual cycle [7].The normal menstrual cycle is associated with cyclical variation in LH ,FSH , sex steroids and inhibin.Proliferative phase is predominantly the estrogen phase and secretory phase is predominantly progestational phase .The variation in HRV parameters observed in the studies stated so far could be due to hormonal influence. But this hypothesis could not be supported because in most of these studies done no correlation was observed between hormonal levels and HRV parameters .Besides the sex hormones , other humoral factors like leptin may also play an important role in altering the HRV measures .Receptors for leptin has been found in the walls of the heart as well as in the vascular endothelium .Studies have reported that there is variation in the leptin levels across the three phases of menstrual cycle .Leptin levels was found to be significantly less in follicular phase when compared to the menstrual and luteal phase. Leptin levels was found to positively correlate with the HRV parameters [8] .In this study we observed an increase in LF values and LF/HF ratio in menstrual phase but we have not estimated the hormone levels . The increase in the LF and LF/HF ratio indicates that the basal sympathetic activity was more during menstrual phase when compared to the other phases . This probably could be due to the variation leptin levels which in turn might influence the Heart rate variability (HRV)parameters by its action on its receptors on the heart. Hence it is necessary to explore the action of leptin on SA node that in turn helps in regulating the heart rate .

We also observed an increase in the diastolic blood pressure during the menstrual phase of the cycle . This increase in diastolic blood pressure is an indicator of increased sympathetic activity. In a study done by poldermann et al it was observed that Endothelin -1 levels in menstrual phase was higher in the non –oral contraceptive users when compared to the proliferative and secretory phase [9] .Endothelin is a potentvasoconstrictor. An increase in endothelin levels may cause vasoconstriction thus increasing the peripheral resistance which probably is manifested as an increase in diastolic blood pressure.Measurement of endothelinlevels across the three phases of menstrual cycle and correlating it with HRV parameters might throw light about the other factors which may influence the HRV parameters.

CONCLUSION

It was observed that the LF values indicating sympathetic activity was higher in menstrual phase when compared to the proliferative and secretory phase . LF values slightly correlated positively with the BMI. Diastolic Blood Pressure was increased in menstrual phase when compared to proliferative and secretory phase. Hence, there is a change in the resting autonomic tone across the different phases of menstrual cycle.

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