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Original Research Article

Comparative Study of Heart Rate Variability Parameters in Supine Posture in Both Genders

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Abstract: The aim of present study was to compare the heart rate variability parameters in healthy adult males and females. It is known that many factors influence the heart rate variability, one of which is gender. Gender difference in heart rate variability parameters is due to different activity of autonomic nervous system in both genders. Fifty healthy young males with age 18-25 years and BMI 18-25 kg/m^2 taken part in this study. HRV parameters of subjects were recorded after making them comfortable by resting in supine posture for 15 minutes. The recording was done in 5 minutes in the supine position by Recorder and Medicare System (P) Ltd. (RMS) Polyrite D. Intergroup comparison between male and female was done by using unpaired‘t’ test. HRV parameters like mean R-R interval, mean values of low frequency in normalized unit (LF nu), mean values Total Power (TP) and mean values of LF/HF ratio were high in males than females but mean high frequency in normalized unit (HF nu) were high in females than males. Males have sympathetic dominance whereas females have parasympathetic dominance.
Keywords: R-R interval, low frequency in normalized unit (LF nu), Total Power (TP), LF/HF ratio and very low frequency (VLF).

INTRODUCTION

Heart rate variability (HRV) is the beat to beat variation in the heart rate, rhythm or the variation in the R-R interval [1]. Variation in the beat to beat interval is a physiological phenomenon. This beat to beat variation occurs due to continuous changes in the sympathetic and parasympathetic outflow to heart [2].

Heart rate fluctuations occur with respiration normally (increasing during inspiration and decreasing during expiration), which is called as respiratory sinus arrhythmia (RSA) and this respiratory sinus arrhythmia is predominantly mediated by respiratory gating of parasympathetic efferent activity of the heart [3].

The status of autonomic nervous system (ANS) outflow to the heart may be evaluated with a number of techniques wherein analysis of Heart rate variability (HRV) is a simple and powerful non-invasive electro-physiological tool having various practical uses with a minimum of technical and operational difficulties, which makes it a useful tool to assess autonomic functioning [4-5].

The analysis of HRV is used in Time, Frequency and Non –linear domains. For short-term HRV measure of 5 minutes, the Frequency and Non – linear methods of HRV evaluation are taken into consideration in order to assess and comment on the dynamic state of the autonomics [2]. The Power Spectral analysis of HRV is characterized by four main components:

- **Total power** - a power spectrum of R-R intervals calculated for a frequency range from 0.0033 Hz to 0.4 Hz. It represents the effect of

the autonomic regulation of cardiovascular function.

- **High frequency** (HF) component (0.15Hz - 0.40Hz) -measures the influence of the vagus nerve in modulating the sino-atrial node and the inspiratory inhibition of the parasympathetic activity.
- **Low frequency** (LF) component (0.04Hz-0.15Hz) - influenced by Baro-receptor mediated regulation of blood pressure and reflect predominant sympathetic activity.
- **Very low frequency** (VLF) component (0.003Hz -0.04 Hz) reflects the influence of several factors on the heart, including chemo receptors, thermo receptors, the renin-angiotensin system, and other non-regular factors [4].

The neural regulation of circulatory function is mainly affected through the interplay of the sympathetic and parasympathetic outflows [6]. This autonomic regulation of the cardiovascular system is affected by various factors such as: genetic characteristics, anthropometric (body mass and height), age, gender, hormonal and emotional factors, level of physical fitness and state of health [7].

Environmental changes like noise, temperature, light, posture, time of the day, workload, stress, behavior, and food intake also affect Heart Rate (HR) at rest [4].

Among normal, healthy adults, there are gender-related differences in cardiac autonomic modulation. Males are under the dominance of sympathetic system, whereas females are under the dominance of the parasympathetic system. The lower sympathetic activity in females may provide protection against arrhythmias and against the development of coronary heart disease in females [4,5,11].

This study was conducted in healthy adult males and females in department of physiology S.M.S. medical college, Jaipur, which could be useful for early diagnosis and assessing autonomic functions and dysfunctions.

METHODOLOGY

Fifty healthy young adult males and fifty healthy young adult females with age 18-25years and BMI 18-25 kg/m^2 taken part in this study. A brief history and general physical examination of all the volunteers were done to exclude subjects satisfying exclusion criteria. The study was carried out between 9.30 am – 12.00 pm after consuming a light standard breakfast 2 hrs before arrival. Subjects were instructed a day before to avoid all drinks containing caffeine and other stimulant 12 hrs before the study and strenuous exercise 24 hrs before the study. The procedure was explained and informed consent was obtained after the subjects had read a description of the experimental protocol, which was approved by the ethical committee of the college. The height, weight of the subject was measured with measuring inch tape, weighing machine respectively.

HRV parameters of subjects were recorded after making them comfortable by resting in supine posture for 15 minutes. The recording was done in 5 minutes in the supine position. For short term analysis of HRV, room ambient temperature was maintained between 24-25^o Celsius. The subject was instructed to breath quietly during the entire recording period with closed eyes and to avoid talking, any movement of the body, coughing and sleeping during the test. Data are presented as mean ± standard deviation with their reference units. Mean ± standard deviation of the observation for all the parameters was calculated. Intergroup comparison between male and female was done by using unpaired 't' test,. The statistical analysis was done by MS-Excel and primer of Biostatistics (version 6.0) P-value<0.05 is taken as significant and P-value<0.001 is taken as highly significant.

RESULT

The mean R-R interval for males in supine posture is 0.76±0.11, and for females is 0.74±0.11. The mean difference in mean R-R interval between males and females in supine posture is 0.019 which is not significant ($p > 0.05$). **[Table 1]**

The mean low frequency in normalized unit (LF nu) for males in supine posture is56.03±15.23, and for females is 51.17±14.09. The mean difference in mean R-R interval between males and females in supine posture is 4.86 which is not significant ($p > 0.05$). **[Table 2]**

The mean high frequency in normalized unit (HF nu) for males in supine posture is43.46±15.23, and for females is 48.83±14.09. The mean difference in mean HF (nu) between males and females in supine posture is -4.86 which not significant ($p > 0.05$) is. **[Table 3]**

The mean TP for males in supine posture is 733.3±569.51, and for females is 665±466.79. The

mean difference in mean TP between males and females in supine posture is 68.27 which is not significant ($p > 0.05$). **[Table 4]**

The mean LF/HF ratio for males in supine posture is1.57±0.94, and for females is1.26±0.82 . The mean difference in mean LF/HF ratio between males and females in supine posture is 0.33 which is not significant ($p > 0.05$). **[Table 5]**

Table-1: Comparison of mean values of mean R-R interval (second) in between males and females in supine posture by unpaired't' test

Parameter	Gender	Mean± SD	Mean difference	t-value	DF	P-value	Significance
Mean R-R interval (second)	M	0.76±0.11	0.019	0.867	98	0.388	NS
	F	0.74±0.11					

Table-2: Comparison of mean values of Low frequency normalized unit (L.F.nu) in between males and females in supine posture by unpaired't' test.

Parameter	Gender	Mean± SD	Mean difference	t-value	DF	P-value	Significance
L. F. nu (normalized unit)	M	56.03±15.23	4.86	1.66	98	0.101	NS
	F	51.17±14.09					

Table-3: Comparison of mean values of High frequency normalized unit (H.F.nu) in between males and females in supine posture by unpaired't' test.

Parameter	Gender	Mean± SD	Mean difference	t-value	DF	P-value	Significance
H. F. nu (normalized unit)	M	43.46±15.23	-4.86	-1.66	98	0.101	NS
	F	48.83±14.09					

Table-4: Comparison of mean values of Total Power (T.P. in $ms^{2)}$ in between males and females in supine posture by unpaired't' test.

Parameter	Gender	Mean± SD	Mean difference	t-value	DF	P-value	Significance
T.P. (ms^2	M	733.3±569.51	68.27	0.656	98	0.514	NS
	F	665±466.79					

Table-5: Comparison of mean values of LF /HF ratio in between males and females in supine posture by unpaired 't' test.

Parameter	Gender	Mean± SD	Mean difference	t-value	DF	P-value	Significance
LF /HF ratio	M	1.57±0.94	0.33	1.87	98	0.065	NS
	F	1.26±0.82					

(NS) Non significant, (S) Significant P-value<0.05, (HS) Highly significant P-value<0.001

DISCUSSION

Continuous monitoring of the heart activity is obtained by means of an Electrocardiogram (ECG). Studying the fluctuations of heart beat intervals over time reveals a lot of information and is called heart rate variability (HRV) analysis. A reduction of HRV has been reported in several cardiological and non-cardiological diseases. Moreover, HRV also has a prognostic value and is therefore very important in modeling the cardiac risk [1-4].

In our study we compared the change in HRV parameters in supine posture among both males and females.

When we compared the mean values of mean R-R interval between males and females in supine

posture by unpaired‘t’ test. The mean values of mean R-R interval were high among the male group and this difference was not significant statistically **[Table-1]**.

Our result were similar with study by Iain A D o'brien *et al*. [9], A. D. Ryan *et al*. [8], Phyllis K. Stein *et al*. [10] their result showed that the mean values of mean R-R interval were high in men than women and and this difference was not significant statistically.

Our result was controversy with study by Dr. Sanhita Rajan Walawalkar [4], Joyce M *et al*. [16] they found the mean values of mean R-R interval were high in men than women and and this difference was significant statistically.

The differences in mean R-R interval between males and females is due to difference in sympathetic and parasympathetic autonomic activity with males showing greater sympathetic influence whereas females showing parasympathetic preponderance. It was suggested that the mechanisms behind gender-related differences in autonomic modulation of heart rate are probably more closely related to hormonal or genetic factors [4,5,11].

When we compared the mean values of low frequency (LF) between males and females in supine posture by unpaired‘t’ test. The mean values of low frequency (LF) were high among the male group and this difference was not significant statistically **[Table-2]**.

Our results were similar with study by A. D. Ryan *et al*. [8] their results showed that the mean values of low frequency (LF) were high in men than women and this difference was not significant statistically.

Phyllis K. Stein *et al*. [10], Shemaila Saleem *et al*. [12], D. Ramaekers *et al*. [13] their results showed that the mean values of low frequency (LF) were high in men than women and this difference was significant statistically.

LF was higher in males than in females is because of that LF component of HRV, which is associated with sympathetic tone, is higher in males than females. There appears to be a correlation between the hormonal levels in female HPG axis and the ANS control of their cardiac activity [14].

When we compared the mean values of high frequency (HF) between males and females in supine posture by unpaired‘t’ test. The mean values of high frequency (HF) were high among the female group and this difference was not significant statistically **[Table-3]**.

Our result were similar with Phyllis K. Stein *et al*. [10], Shemaila Saleem *et al*. [12] their results showed that the mean values of high frequency (HF) were high in women than men and this difference was not significant statistically.

Study by A. D. Ryan *et al*. [8], D. Ramaekers *et al*. [13] their result showed that the mean values of high frequency (HF) were high in women than men and this difference was significant statistically.

In our study, the base line of mean HF is higher in females, in contrast to other parameters of HRV, which are higher in males. This is because of parasympathetic tone dominates over sympathetic in women and vice versa in men [1,14].

When we Compared the mean values Total Power (TP) between males and females in supine posture by unpaired ‘t’ test. The mean values of Total Power (TP) were high among the male group and this difference was not significant statistically. **[Table-4]**.

Our result were similar with Phyllis K. Stein *et al*. [10], Shemaila Saleem *et al*. [12], A. D. Ryan *et al*. [8] their results showed that the mean values of Total Power (TP) were high in men than women and this difference was not significant statistically.

When we Compared the mean values of LF/HF ratio between males and females in supine posture by unpaired‘t’ test . The mean values of LF/HF ratio were high among the male group and this difference was not significant statistically **[Table-5]**.

Our result were similar with study by Phyllis K. Stein *et al*. [10] their result showed that the mean values of LF/HF ratio were high in men than women and this difference was not significant statistically.

Study by D. Ramaekers *et al*. [13] their result showed that the mean values of LF/HF ratio were high in men than women and this difference was significant statistically.

The high LF/HF ratio in males then females may reflect a higher sympathetic activity in males compared to females [6, 5].

CONCLUSION

This study shows that males show sympathetic dominance whereas females show parasympathetic dominance. The regular assessment of autonomic functions can be used as an important indicator because of its easy performance, non-invasive, cost effective method for early detection and subsequent management of cardiovascular morbidity and mortality in healthy young adults.

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