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Short Communication

Physiology Section

Alternate Nostril Breathing at Different Rates and its Influence on Heart Rate Variability in Non Practitioners of Yoga

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ABSTRACT

Introduction: Heart rate variability is a measure of modulation in autonomic input to the heart and is one of the markers of autonomic functions. Though there are many studies on the long term influence of breathing on HRV (heart rate variability) there are only a few studies on the immediate effect of breathing especially alternate nostril breathing on HRV. This study focuses on the immediate effects of alternate nostril breathing and the influence of different breathing rates on HRV.

Materials and Methods: The study was done on 25 subjects in the age group of 17-35 years. ECG and respiration were recorded before intervention and immediately after the subjects were asked to perform alternate nostril breathing for five minutes.

Results: Low frequency (LF) which is a marker of sympathetic activity increased, high frequency (HF) which is a marker of parasympathetic activity decreased and their ratio LF/HF which is a marker of sympatho/vagal balance increased immediately after 6 and 12 minutes in comparison to baseline values whereas there was no significant difference in the means of these components when both 6 and 12 minutes were compared.

Conclusion: Immediate effects of alternate nostril breathing on HRV in non practitioners of yogic breathing are very different from the long term influence of yogic breathing on HRV which show a predominant parasympathetic influence on the heart.

Keywords: LF, HF, Sympathetic, Parasympathetic

INTRODUCTION

Heart rate variability being one of the markers of autonomic functions is being studied extensively now-a-days because of the increasing incidence of cardiac deaths throughout the world. Heart rate variability (HRV) is a measure of modulation in autonomic input to the heart. When heart rate or RR intervals are measured continuously it is seen that the interval between two consecutive heart beats or RR intervals is not constant and it varies continuously. This variation is because of fluctuations in autonomic inputs to the heart. The sinus node is under the control of both sympathetic and parasympathetic efferents which are in turn controlled by various central and peripheral mechanisms thereby exerting beat-beat control on the heart resulting in oscillations of heart rhythm. This beat-beat variation is called heart rate variability [1-5].

Beat-beat autonomic modulation to the heart can be evaluated using various types of analysis like time domain and frequency domain analysis [1-5]. A Fast Fourier Transformation (FFT) which is ideally used for short term HRV analysis divides the entire spectrum into three main components which are the high frequency (HF), low frequency (LF), Very low frequency components (VLF) [1-5]. According to literature high frequency (HF) component is a marker of parasympathetic activity whereas low frequency component (LF) is considered by some as a marker of sympathetic activity and by others as a marker of both parasympathetic and sympathetic activity. Hence accordingly LF/HF represents either sympathetic modulation to the heart or as a marker of sympatho/vagal balance [1].

Though there are many studies on the long term influence of breathing on HRV [6,7], there are only a few studies on the immediate effect of breathing especially alternate nostril breathing (ANB) on HRV, also the results contradict each other [8-11]. Over a period of time parasympathetic predominance is established as a result of practising long term breathing exercises. Is there an increase in cardiac autonomic modulation immediately following alternate nostril breathing? If so can short term alternate nostril breathing exercises be advocated to patients at risk of developing cardiac disabilities especially hypertension, Myocardial infarction etc since there is decreased compliance with long term yogic breathing exercises? Hence this study focuses on the immediate effects of alternate nostril breathing (ANB) and the influence of different breathing rates on HRV. Non practitioners of yoga have been selected because increased cardiac autonomic modulation has already been established in people practising yoga. There are no studies so far which have reported the comparison of alternate nostril breathing paced at different breathing rates.

MATERIALS AND METHODS

Subjects were recruited after clearly explaining the study to them and after obtaining their written informed consent. Twenty five subjects in the age group of 17-35 years with a BMI of less than 26 were included in the study. The study was carried out after obtaining the institutional ethical clearance. Smoking, alcohol consumption, any major medical or surgical illness and regular practice of yoga or any other form of breathing exercise were the exclusion criteria. At the time of recruitment the methodology was explained to them and they were given training for 5 minutes to practise alternate nostril breathing at rates of 6 and 12 breaths per minute. After recruitment they were asked to come at a later date for the test and the pretest requirements were also explained to them. The subjects were asked to come either without breakfast or two hours after a light breakfast without coffee or tea after a restful 7-8 hours of sleep at night for the test.

ECG in lead II position and respiratory rate were recorded. Respiration was recorded using a respiratory belt and signal acquisition was done using RMS Polyrite data acquisition system. Subjects were asked to sit facing away from the computer after fixing all the leads. Initially a resting ECG was taken for 5-10 minutes after 15 minutes of rest. Following this subjects were asked to perform alternate nostril breathing at a rate of either 6 or 12 breaths per minute for 10 minutes after which ECG was recorded immediately for 5 minutes. Alternate nostril breathing was performed again at a different rate of either 6 or 12 after 15 minutes of rest. This was also immediately followed by an ECG recording of 5 minutes. Breathing rate was controlled by a continuous pre-recorded voice command.

Technique of alternate nostril breathing: The subjects were asked to inhale through either one of the nostrils keeping the other one closed as long as the voice command instructed them to do so, and were then asked to momentarily hold their breath and exhale through the other nostril keeping the nostril through which they inhaled closed as long as the voice command instructed them to do so. Inspiration-expiration ratio was maintained at 2:3 in both the breathing rates to mimic normal respiration. HRV was analyzed using RMS Polyrite software and the FFT data was used for the analysis. Repeated measures ANOVA was done to compare the means; SPSS and Microsoft Excel were used for the analysis. p-less than 0.05 was taken as statistically significant.

RESULTS

The results are given as mean±SD in [Table/Fig-1]. It is evident from the table that LF increased both after 6 and 12 minutes of breathing whereas HF decreased in both the cases. Hence there is an increase in LF/HF ratio. Paired t-test was done to compare the means of baseline/resting values and 6/12 minute values. Statistical significance was obtained ($p > 0.05$) in the above conditions for all the three parameters LF, HF and LF/HF. given in [Table/Fig-2]. Significance was not obtained with repeated measures ANOVA (p=0.07), Though significance was not obtained in any of the comparisons, the p-values for the LF, HF and LF/HF comparisons between rest and 6 minutes and 12 minutes were closer to 0.05 (0.065, 0.074 and 0.059 respectively) are given in [Table/Fig-3].

LF Rest	HF rest	LF/HF Rest	LF 6 min	HF 6 min	LF/HF 6 min	LF 12 min	HF 12 min	LF/HF 12 min
70.17 ± 13.42	29.86 ± 13.47	2.97 ± 1.59	77.65 ± 11.22	22.4 ± 11.21	4.6 ± 2.56	76.12 ± 10.34	23.92 ± 10.44	4.26 ± 2.98

[Table/Fig-1]: FFT spectral values - LF, HF and LF/HF; N = 25

LF Rest and 6 min	HF rest and 6 min	LF/HF Rest and 6 min	LF rest and 12 min	HF rest and 12 min	LF/HF rest and 12 min	LF 6 and 12 min	HF 6 and 12 min	LF/HF 6 and 12 min
0.002*	0.002*	0.000**	0.02*	0.03*	0.02*	0.63	0.63	0.68

[Table/Fig-2]: p-values-student t-test (* p< 0.05 and ** p< 0.01); N = 25

LF Rest LF6 min and LF 12 mins	HF rest, 6 min and 12 min	LF/HF Rest, 6 min and 12 min
P= 0.065	0.074	0.059

[Table/Fig-3]: Repeated measures ANOVA; N = 25.

DISCUSSION

This study was done to study the immediate effects of alternate nostril breathing on short term HRV parameters and to compare the effects of different breathing rates on HRV. Since for short term HRV analysis FFT spectral values are more suitable [1]. Components of power spectral analysis LF, HF and LF/HF were mainly studied. Ideally since VLF should be interpreted only in long term HRV recordings of 24 hours it is not taken into consideration for the analysis [1]. Previous studies have shown that regular practice of deep breathing exercises and yogic breathing like pranayama and alternate nostril breathing improve the heart rate variability and have shown a predominant parasympathetic influence on the heart [6,7]. Very few studies are there on the immediate effects of alternate nostril breathing on HRV [8-11] of which some studies have shown a predominant parasympathetic influence on the heart [8,11] and some a predominant sympathetic influence on the heart [9]. LF in n.u is taken as a marker of sympathetic activity though parasympathetic influence also reflects LF values whereas HF is taken as a marker of parasympathetic predominance on the heart and LF/HF reflects sympatho vagal balance [1]. Though statistical significance has not been obtained for comparisons between rest and 6 minutes and 12 minutes, since the p-values are closer to 0.05 (p=0.065, 0.074), it can be said here that LF has increased, HF has decreased and LF/HF ratio has increased following both 6 and 12 minutes of breathing as compared to baseline/resting values [Table/Fig-1-3]. Therefore there is a predominance of sympathetic influence on the heart immediately following alternate nostril breathing which is in contradiction to an earlier study on alternate nostril breathing which has concluded an enhanced autonomic modulation without a shift in sympathovagal balance [11]. The authors had reported an increase in both LF and HF without any change in LF/HF following both alternate nostril breathing and paced breathing at 5 breaths/minute in comparison to baseline values and therefore had concluded that the effects on HRV following alternate nostril breathing could have been primarily mediated by different breathing rates in persons who are not regular practitioners of yogic breathing [11]. Hence in this study we decided to compare alternate nostril breathing at two different breathing rates and it is seen that there is no significant difference in any of the FFT spectral components between the groups – rest, 6 breaths/min and 12 breaths/min [Table/Fig-3] which says breathing rate may not in any way influence the HRV parameters in people who are not practising any form of yogic breathing.

CONCLUSION

The immediate effects of alternate nostril breathing on HRV in non practitioners of yogic breathing are very different from the long term influence of yogic breathing on HRV which show a predominant parasympathetic influence on the heart. The increase in LF which is seen immediately after the intervention is a marker of autonomic modulation of the heart whereas the baseline LF values if found to be higher is detrimental to the heart. The study would have been more valid with a bigger sample size and with autonomic functions as part of it hence these are the limitations of the study.

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