

A Study to Evaluate the Effects of Visual Stimuli on Cardiac Autonomic Activity Using HRV in Middle Aged Males: A Prospective Study

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Conflict of interest: Nil

Abstract

Objective: To test the effect of visual stimuli on HRV in middle aged males.

Materials and Methods: The present 1 year prospective study was conducted in the Department of Physiology, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. The effects of visual stimuli on cardiac autonomic activity using HRV were studied in 50 healthy middle aged males. Beat to beat R-R intervals were continuously recorded under closed eye condition and the open eye condition.

Results: The mean value of HF nu for under CEC was significantly greater (<0.05 level) when compared to OEC. The values of LF nu and LF/HF under CEC appear to be smaller than those OEC.

Conclusion: When compared to the open eye condition, when the eyes are closed state of the eyes. Closing your eyes for a few moments could benefit your heart by enhancing the parasympathetic component of cardiac autonomic activity. The cardiac autonomic activity component increased.

Keywords: Autonomic activity, Heart Rate Variability, visual stimuli.

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Introduction

During the last few decades, particularly following the publication of the guidelines on heart rate variability (HRV), the importance of HRV as a tool for assessing the autonomic nervous system activity in many different diseases and conditions has steadily increased.[1]

The HRV describes the complex variation of beat-to-beat intervals mainly controlled by the autonomic nervous system (ANS) through the interplay of sympathetic and

parasympathetic neural activity at the sinus node [2]. In healthy subjects, typically showing a pronounced inter individual HRV [3], the dynamic cardiovascular control system is characterized by its ability to adapt to physiologic perturbations and changing conditions maintaining the cardiovascular homeostasis [4].

Physiological responses to environmental stimuli have been investigated intensely[5, 6]. Heart rate at rest is regulated through

the activity of cardiac autonomic nervous system. The stimulation in the sympathetic nervous system increases heart rate and excitation of parasympathetic nervous system reduces heart rate by increasing vagal tone.

Heart Rate Variability (HRV) is a specific and sensitive non-invasive tool to evaluate cardiac autonomic activity. HRV is the degree of variation of the heart rate under the balanced influence of sympathetic and parasympathetic components of the cardiac autonomic nervous system. HRV also indicates the extent of neuronal damage to autonomic nervous system. Human beings are very sensitive to light exposure, and changes of light intensity can shift many physiological parameters like melatonin, alertness, body temperature, heart rate (HR), and heart rate variability

(HRV)[7, 8].

Thus, this study was undertaken to test the effect of visual stimuli on HRV in middle aged males.

Materials and Methods:

The present 1 year prospective study was conducted in the Department of Physiology, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India.

Inclusion and exclusion criteria

Healthy 80 males of middle age group of 45-65 years were included in the study. Subjects who are obese or with history of diabetes mellitus, hypertension, respiratory illness, cardiac diseases and endocrinal

disorders were excluded. Subjects on any medications were also excluded.

Methodology

The effects of visual stimuli on cardiac autonomic activity using HRV was studied in 50 healthy middle aged males. Beat to beat R-R intervals were continuously recorded under closed eye condition and the open eye condition. HRV frequency domain parameters like LF nu, HF nu, LF/HF were obtained with the help of RMS polyrite – D version3.0.11.

Statistical analysis

Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups Inter group analysis. Significance is assessed at 5% level of significance.

Results:

This study signifies that closing eyes for a while might help heart by increasing the parasympathetic component of the cardiac autonomic activity and the parasympathetic component of the cardiac autonomic activity increased during the closed eye condition when compared to the open eye condition. The mean value of HF nu for under CEC was significantly greater (<0.05 level) when compared to OEC.

The values of LF nu and LF/HF under CEC appear to be smaller than those OEC.

Table 1: Basic characteristics of subjects

Variables	Subjects
Age in years	47.28±1.67
BMI (kg/m ²)	25.62±0.45

Table 2: Comparison of FFT spectrum between CEC and OEC

HRV	CEC	OEC	p-value
LF nu	32.701±3.92	36.291±4.983	<0.05*

HF nu	71.629±6.621	68.271±4.720	<0.05*
LF/HF	0.582±0.07	0.682±0.08	<0.05*

Discussion:

Light plays a central role in life. Without sunlight there is no life on earth. Effects of light stimulation and light therapy on autonomic functions (e.g., body temperature, HR, or HRV) were already investigated in several human studies[9,10,and 11].

Snieder et al. [12] found in 196 male and 210 female middle-aged twins that oral contraceptive use and menopausal status had no effect on HRV. However, Moodithaya et al. [13] concluded that both aging and declined estrogen levels are associated with the autonomic alterations that are seen among postmenopausal women.

As reported in [14], directly comparing the values of frequency domain indices from various studies is quite difficult due to the different calculation modes (such as fast Fourier transform vs. autoregressive methods, different window functions, partly spectral corrections and others) and due to the units of the result values (e.g. ms², natural or common logarithm).Litscher D et al indicated that changes in the activity of parasympathetic nervous system can alter heart rate much more rapidly exerting beat –by –beat control of heart rate compared to sympathetic nervous system. LF-HF ratio is sensitive measure of sympathovagal balance.[15]C. Cajochen et al. showed that increase in LF-HF ratio indicates increased sympathetic activity and decrease in ratio indicates increased parasympathetic

activity. HFnu is an index of parasympathetic activity.[16] Increase in LF-HF ratio indicates increased sympathetic activity and decrease in ratio

indicates increased parasympathetic activity[17]. HFnu is an index of parasympathetic activity. In one of the studies participants who were exposed to red light (versus a control color) exhibited a decrease in HF-HRV, and this result was associated with worse cognitive performance[18].LF-HF ratio is sensitive measure of sympathovagal balance [19,20].

Conclusion:

When compared to the open eye condition, when the eyes are closed state of the eyes. Closing your eyes for a few moments could benefit your heart by enhancing the parasympathetic component of cardiac autonomic activity. The cardiac autonomic activity component increased.

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