

Influence of Deep Breathing Exercise for A Short Duration on Heart Rate Variability in Healthy Young Individuals

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Abstract

Previous studies have reported and documented the beneficial effects of deep breathing as a part of either short term or long term practice of pranayama. Few studies have shown increase in Heart rate variability (HRV) on performing non yogic deep breathing exercise for a long period. However our knowledge about the effects of few minutes of deep breathing exercise (DB) on HRV is lacking. In the present study we examined the effects of few minutes of deep breathing exercise (DB) on HRV. The study was conducted on a homogenous group of 17 male students. The students performed deep breathing exercises for 3 minutes at the rate of 6 breaths per minute; short term HRV indices were assessed before and after deep breathing exercise. The data analysis was carried out by using SPSS19.0 software. Results were expressed as mean & standard deviation. A P-value of < 0.001 was considered as highly significant. The mean LF, HF & LF/HF ratio before DB exercise was 46.07 ± 11.03 , 50.97 ± 8.67 & 0.95 ± 0.36 . The mean LF, HF & LF/HF ratio after DB exercise was 36.68 ± 11.76 , 58.29 ± 9.64 & 0.67 ± 0.32 . Mean differences in all parameters before and after DB exercise was found to be statistically significant. There was a significant decrease in the sympathetic tone (LF) & a significant increase in the parasympathetic tone (HF) after DB exercise. This shows that deep breathing for few minutes has a beneficial effect on heart.

Keywords: Deep Breathing Exercise; Heart Rate Variability.

Introduction

The origin of Yoga as a religious tradition occurred in India few thousands of years ago. Yoga is the best lifestyle modification, which aims to attain the unity of mind, body and spirit through asanas (exercise), pranayama (breathing), and meditation [1].

Pranayama is the art of prolongation and control of breath helps in bringing conscious awareness to breathing and the reshaping of breathing habits and patterns [2]. According to the ancient yogic literature, certain breathing practices have been known to exhibit inhibitory as well as stimulating effects which induce calmness and arousal that alter the autonomic status and improve the psychological parameters. Fast breathing (Kapal-bhatipranayama) instantly modifies the autonomic status by increasing the sympathetic tone accompanied with a reduced parasympathetic tone [3,4] while slow deep breathing increases the parasympathetic tone and decreases sympathetic activity and breathing

through a particular nostril and "Om" meditation alters the metabolic and autonomic activities [5,6,7]. Practice of slow deep breathing has also been used as a treatment modality for anxiety disorders as it attenuates cardiac autonomic responses in such patients [8].

Previous studies have reported and documented the beneficial effects of deep breathing as a part of either short term or long term practice of pranayama [9,10]. Few studies have shown variation in Heart rate variability (HRV) on performing non yogic deep breathing exercise for a long period [11,12]. However the knowledge about the effects of few minutes of deep breathing exercise (DB) on HRV is lacking. The present study was designed to find the effects of deep breathing exercise (DB) for duration of 3 minutes on HRV.

Materials and Methods

The study was conducted in a homogenous group of 17 male first year students from Navodaya college

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of Physiotherapy, Raichur. The subjects were in the age group of 18 - 20 years. All the subjects were non-smokers, without any pre-existing disease and were not on any medications. Those already performing some form of yoga or breathing exercises were excluded from the study. Informed written consent was obtained after explaining the procedure and protocol.

Methodology

The students were trained to perform slow deep breathing exercise for duration of 3 minutes at the rate of 6-8 breaths per minute by one of the investigators. All the students were asked to report to the Department at 8.30 am in the morning on empty stomach. Before starting the procedure the subject was given 15 min rest. Heart rate variability was recorded using instrument Power lab 8/30 series with dual bio amplifier, (Manufactured by AD instruments, Australia, with model no ML870). To quantify heart rate, the analogue ECG signal was obtained using lead II to obtain a QRS complex of sufficient amplitude and stable base line. First ECG was recorded for a period of 5 minutes, with subject in supine, eyes closed and awake state. The subject was then advised to perform slow deep breathing exercise for a period

of 3 minutes at a rate of 6-8 breaths per minute in sitting position. Second ECG was recorded immediately after the deep breathing exercise with the subject in supine, eyes closed and awake state. The data gathered was subjected to frequency domain analysis of HRV. The frequency domain parameters including Low frequency (LF) and High frequency (HF) power and LF/HF ratio were calculated for ECG acquired at every time point. Short term HRV indices were assessed before and after deep breathing exercise. The data analysis was carried out by using SPSS19.0 software. Results were expressed as mean & standard deviation. A P-value of < 0.001 was considered as highly significant.

Results

The mean LF, HF & LF/HF ratio before DB exercise was 46.07 ± 11.03 , 50.97 ± 8.67 & 0.95 ± 0.36 . The mean LF, HF & LF/HF ratio after DB exercise was 36.68 ± 11.76 , 58.29 ± 9.64 & 0.67 ± 0.32 . Mean differences in all parameters before and after DB exercise was found to be statistically significant. There was a significant decrease in the sympathetic tone (LF) & a significant increase in the parasympathetic tone (HF) after DB exercise.

Table 1: Different HRV indices before and after exercise (Paired t test)

HRV indices	Exercise	N	Mean	Std. Deviation	t	DF	p	Inference
LF	Before	17	46.07	11.03	15.942	16	.0001	Highly significant
	After	17	36.68	11.76				
HF	Before	17	50.97	8.67	-12.978	16	.0001	Highly significant
	After	17	58.29	9.64				
LF/HF	Before	17	.95	.36	16.198	16	.0001	Highly significant
	After	17	.67	.32				

Discussion

In the present study we saw a significant decrease in the sympathetic tone and a significant increase in the parasympathetic tone after performing slow deep breathing exercise for a short duration of 3 minutes. Slow deep breathing exercise generates inhibitory signals and hyperpolarizing current within neural and non-neural tissue by mechanically stretching tissues during breath inhalation and retention. It is likely that inhibitory impulses in cooperation with hyperpolarization current initiates the synchronization of neural elements in the central nervous system, peripheral nervous system, and

surrounding tissues ultimately causing shifts in the autonomic balance towards parasympathetic dominance. Short-term effects of slow pranayamic breathing include decreased oxygen consumption [13], decreased heart rate, decreased blood pressure [14], and increased amplitude of theta waves [15]. Increase theta amplitude and delta waves during breath retention and slow breathing is indicative of a parasympathetic state. There are several chemical and non-chemical mechanisms that may account for some of the physiologic phenomena experienced by pranayama practitioners. No significant changes in arterial blood gases were noted after pranayama practice indicating a neural mechanism for pranayama's effect [16]. Breath holding, an essential

part of pranayama, is shown to induce theta waves [15]. A decrease in breathing frequency can increase synchronization of brain waves eliciting delta wave activity [17] indicating parasympathetic dominance.

Conclusion

Our study confirms that simple deep breathing even for few minutes has a beneficial effect on heart.

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