**IMMEDIATE EFFECT OF SHORT DURATION OF SLOW DEEP BREATHING ON HEART RATE VARIABILITY IN HEALTHY ADULTS**

**Background:** Various types of breathing exercises have various effects on autonomic nervous system like fast breathing increases sympathetic tone and slow breathing increases parasympathetic tone. But these changes are seen when those exercises are done for long duration. Heart rate variability (HRV) reveals the autonomic status very effectively. So took up the study to know the effects of short duration (5 min) of slow deep breathing on heart rate variability.

**Aims & Objective:** To study the HRV Before and after five minutes of slow deep breathing in healthy adults.

**Materials and Methods:** 20 healthy adults aged between 30 to 40 years and not practicing any kind of breathing exercises or yoga were involved in the study. Using powerlab, AD Instrument polyrite, HRV was calculated by recording ECG in Lead II for five minutes. Then the participants were made to slow deep breathe for 5 minutes, again HRV was calculated. The time domain parameters of HRV studied were Standard deviation of all normal-to-normal intervals in milliseconds (SDNN) and Root Mean Square Successive Difference in milliseconds (RMSSD). The frequency domain parameters studied were low frequency in normalized units (LF nu), high frequency in normalized units (HFnu) and the ratio of LF to HF (LF/HF ratio).

**Results:** Heart rate did not show much of variation. There was significant increase in LFnu (46.9±14.51, 60.79±17.29 and p 0.009), decrease in HFnu (43.56±17.59, 30.17±13.52 and p 0.002), increase in LF/HF ratio (1.43±0.84, 3.06±3.22 and p 0.03). SDNN and RMSSD did not show significant change.

**Conclusion:** Effect of slow deep breathing for a short duration of five minutes in healthy adults who are not practising any kind of breathing exercise or yoga is shift of the cardiac sympathovagal balance towards the sympathetic predominance.

**Key Words:** Slow Deep Breathing; Heart Rate Variability (HRV); Short Term Effect

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**INTRODUCTION**

Heart rate variability (HRV) is the physiological phenomenon of variation in the time interval between heartbeats. It is measured by the variation in the beat-to-beat interval. Other terms used include: "cycle length variability", "RR variability", and "heart period variability". So one needs to detect the heartbeat. ECG is considered superior to any other method to detect heart beat because it provides a clear waveform, which makes it easier to analyse. RR interval denotes one cycle. Variation in these RR intervals is Heart Rate Variability (HRV). The term "NN" is used in place of RR to emphasize the fact that the processed beats are "normal" beats.

HRV is a normal phenomenon in healthy individuals. Majority of this variation is contributed by sinus arrhythmia. Sinus arrhythmia is variation of heart rate with phases of respiration i.e. heart rate increases during inspiration and decreases during expiration. It is because of interplay between stretch receptors in lungs and cardiac autonomic nerves. Thus increased HRV is a marker of healthy cardiac autonomic modulatory activity, as well as longevity.

Various types of pranayama and yogic exercises voluntarily alter the respiratory rate, depth of breathing, lung volumes and capacities. So these practices alter the cardiac autonomic modulatory activity. It has been observed that fast pranayam (Kapalbhati) type of breathing exercise increase the sympathetic tone and decrease the vagal tone. Slow pranayama with alternate nostril breathing exercise like nadiisuddhi, showed decreased sympathetic tone and increased parasympathetic tone. But these changes were seen when the particular breathing exercise was performed for long duration.

Previous literature shows the heart rate variability (HRV) spectrum has been established as a probe of beat-to-beat autonomic control. So took up the present study to know whether there is any effect of slow deep breathing for short duration of five minutes on HRV.

**MATERIALS AND METHODS**

It was a cross sectional study. 20 healthy adults participated in the study. Study included healthy adults aged between 30 to 40 years and not practicing any kind
of breathing exercises or yoga. People known to have hypertension, Diabetes mellitus, cardiorespiratory disorders, neurological disorders and not willing to participate in the study were excluded from the study. Participants were called individually to the departmental research laboratory and were briefed about the study design. They were made to rest for 10 minutes. Then, using powerlab, AD Instrument polyrite, a Data acquisition system, Heart Rate Variability was calculated by recording ECG in Lead II for five minutes.

Then the participants were made to slow deep breathe for 5 minutes i.e. six seconds of inhalation and six seconds of exhalation (six breaths per minute). Immediately after the slow deep breathing again Heart Rate Variability was calculated. Heart Rate Variability thus obtained was analysed with respect to time and frequency domain parameters. The time domain parameters studied were Standard deviation of all normal-to-normal intervals in milliseconds (SDNN) and Root Mean Square Successive Difference in milliseconds (RMSSD).

The frequency domain parameters studied were low frequency in normalized units (LFnu), high frequency in normalized units (HFnu) and the ratio of LF to HF (LF/HF ratio). Low frequency and high frequency spectral powers were determined by integrating the power spectrum between 0.04 and 0.15 Hz and between 0.15 and 0.4 Hz respectively.

The data obtained before slow deep breathing was compared with data obtained after slow deep breathing. Results were analysed by paired student’s ‘t’ test using EPI INFO software.

Ethical committee clearance was obtained for the study.

### RESULTS

The mean age of the participants was 36.55±2.89 years. The mean values of heart rate before and after slow deep breathing were 80.02±8.11 and 80.06±6.19 beats per minute respectively. The mean values of LFnu, HFnu, LF/H F ratio, SDNN and RMSSS before and after five minutes of slow deep breathing are tabulated in Table 1 and shown in Figure 1.

There was no significant difference in HR in participants before and after slow deep breathing. There was significant increase in LFnu, decrease in HFnu and increase in LF/HF ratio after five minutes of slow deep breathing when compared to basal values. SDNN did not show any difference before and after five minutes of slow deep breathing. RMSSSD though decreased after slow deep breathing, was not statistically significant.

### DISCUSSION

In our study, HRV analysis showed significantly increased LFnu, decreased HFnu and increased LF/HF ratio with no significant change in SDNN and RMSSSD after five minutes of slow deep breathing when compared to basal values in healthy adults who were not involved in any breathing exercises nor in any yogic practices prior. But the heart rate remained almost the same before and after slow deep breathing.

LFnu reflects the cardiac modulation by sympathetic nervous system with little contribution from parasympathetic nervous system (vagal) while HFnu reflects the parasympathetic modulation alone. LF/HF ratio represents the sympathovagal balance. In our study, we observed slow deep breathing for five minutes shifted the cardiac autonomic balance towards sympathetic nervous system.

SDNN is known to reflect the long term parasympathetic control of the cardia. Since our study aimed at effect of short duration of slow deep breathing, SDNN was not altered much.
RMSSD is known to reflect the short term parasympathetic control of heart. In our study though it decreased, was not statistically significant. Pal GK et al\textsuperscript{11} in their study reported that slow breathing exercise for three months increased parasympathetic tone and decreased sympathetic tone. They also reported that fast breathing exercise increased sympathetic tone and decreased parasympathetic tone in healthy adults.

Similar study done by Bhargava R et al\textsuperscript{12} showed nadi suddhi pranayama (slow breathing) practiced for four weeks, caused decreased heart rate, as well as decreased systolic and diastolic blood pressure levels indicating reduced sympathetic tone and increased parasympathetic tone.

In a study by Raghuraj et al\textsuperscript{13} Kapalbhati (fast breathing) exercise increased sympathetic tone and decreased parasympathetic tone where as in Nadi suddhi (slow breathing) though the results were not significant, there was increased parasympathetic tone and decreased sympathetic tone.

Elizabeth Tharion et al\textsuperscript{14} also reported slow deep breathing for one month significantly increased parasympathetic tone in healthy adults. So slow deep breathing for long duration has produced increased parasympathetic tone and decreased sympathetic tone in healthy adults. In contrast to this finding, our study revealed that slow deep breathing for short duration of five minutes, increases sympathetic tone and decreases parasympathetic tone. Here the participants were not doing any kind of breathing exercises (pranayamic) or yogic exercises prior to the study.

So when they started doing this slow deep breathing exercises for the first time, as Fight or Flight response, sympathetic system might have got activated. When the exercise was done regularly for long duration, slowly sympathetic system tone decreased and parasympathetic tone increased as evidenced by existing literature.

CONCLUSION

Present study revealed that immediate effect of slow deep breathing for a short duration of five minutes in non-yogic healthy adults shifts the cardiac sympathovagal balance towards the sympathetic predominance. This is because when body begins a new exercise for the first time, it is always the sympathetic nervous system that gets activated. When slow deep breathing is continued for long duration, sympathetic tone decreases and parasympathetic tone increases as evidenced by the existing literature.

REFERENCES


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