DOI: 10.7860/JCDR/2013/4750.2948

Original Article

Physiology Section

Assessment of the Effects of Pranayama/Alternate Nostril Breathing on the Parasympathetic Nervous System in Young Adults

ANANT NARAYAN SINHA, DESH DEEPAK, VIMAL SINGH GUSAIN

ABSTRACT

Background and Aim: Pranayama, the art of breath control, is considered to be the heart of yogic exercises. The present study was performed with the aim of evaluating the effect of Pranayama/Alternate Nostril Breathing (A.N.B.) on the parasympathetic nervous system in healthy young adult males.

Methods: A comparative account of the expiratioin: inspiration ratio (E:I ratio) and the orthostatic tolerance test (30:15 ratio) at the basal level, at the start of the study and after the practice of A.N.B for 5 minutes and following a training period of 6 weeks.

Result and Conclusion: This study showed that the parasympathetic tone was enhanced appreciably in the participants. The observations of this study suggest that the yogic exercise of A.N.B. influences the parasympathetic nervous system significantly.

Key Words: Yogic exercises, Pranayama, Alternate nostril breathing (A.N.B.), Parasympathetic nervous system, The E:I ratio, The 30:15 ratio

INTRODUCTION

Breathing through one nostril or alternate nostrils affects the nervous system and it has been studied that right nostril yoga breathing facilitates the activity of the contra lateral (left) cerebral hemisphere [1].

Taking into consideration, the deficiencies in the information which is available on the autonomic function in yoga and to understand the extent to which the autonomic reflexes undergo changes through this ancient yogic practice of Pranayama/Alternate Nostril Breathing (A.N.B.), the present study was aimed at assessing the effects of A.N.B on the parasympathetic nervous system.

MATERIAL AND METHODS

The present study was carried out in the Department of Physiology of a medical institution in north India, over a period of one year. Twenty five healthy, male students who were aged between 18-22 years were included in the study. The mean age, weight and height of the participants were 18.48±0.55 years, 58.76±4.06 kgs and 5.48±0.08 feet respectively. Prior to their inclusion, the participants were well explained about the procedure and informed consents were obtained from them.

All the participants reported after a light breakfast. To assess their parasympathetic function, the deep breathing test (the E:I ratio) and the orthostatic tolerance test (the 30:15 test) were performed. The tests were performed in the morning, with the subjects lying comfortably in a resting state. The Heart Rate (HR) was measured from the R-R interval of the ECG by using lead II of the electro cardiograph machine (BPL cardiart machine). The PNS (parasympathetic nervous system) assessments of the participants were done in the basal condition, after a rest of 10 minutes. Then they were asked to perform A.N.B. for 5 minutes and their PNS was assessed again.

The participants were given A.N.B. (Alternate Nostril Breathing) training for 6 weeks, for 15 minutes daily. After the training, they were called again and were assessed for PNS again at the basal condition and after performing A.N.B. for 5 minutes.

The methods for ANB:

- Sitting in a quiet posture to bring the right hand up to the nose; and to fold the index and the middle fingers so that the right thumb can be used to close the right nostril and the ring finger can be used to close the nostril.
- By closing the right nostril by using the right thumb, the participants were asked to exhale completely through the left nostril. The exhalation was slow, controlled and free from exertion and jerkiness.
- At the end of the exhalation, they were asked to close the left nostril with the ring finger, to open the right nostril and to inhale slowly and completely. The inhalation was slow, smooth, controlled and of the same duration as the exhalation.
- This cycle of exhalation was repeated through the left nostril, followed by inhalation through the right nostril two more times.
- At the end of the third inhalation through the right nostril, they were asked to exhale completely through the right nostril, while still keeping the left nostril closed with the ring finger.
- At the end of this exhalation, they were asked to close the right nostril and to inhale through the left nostril. They were asked to repeat this two more times. This would complete one exercise.

Participants (N=25)	Parasympathetic parameters initially at the start of study (Mean ± SD)			Parasympathetic parameters after 6 weeks of A.N.B. training (Mean ± SD)		
	Basal condition	After A.N.B. for 5 minutes	p- value	Basal condition	After A.N.B. for 5 minutes	p- value
E:I ratio	1.13 ± 0.04	1.15±0.11	>0.05	1.17±0.04	1.20±0.04	<0.05
30:15 ratio	1.09±0.09	1.12±0.08	>0.05	1.16±0.04	1.17±0.03	>0.05

[Table/Fig- 1]: Parasympathetic parameters of the participantsinitially at the start of the study and after 6 weeks of A.N.B. training
E:I ratio = longest RR interval during expiration/Shortest RR interval during inspiration 30:15 ratio = interval of 15th and 30th beats

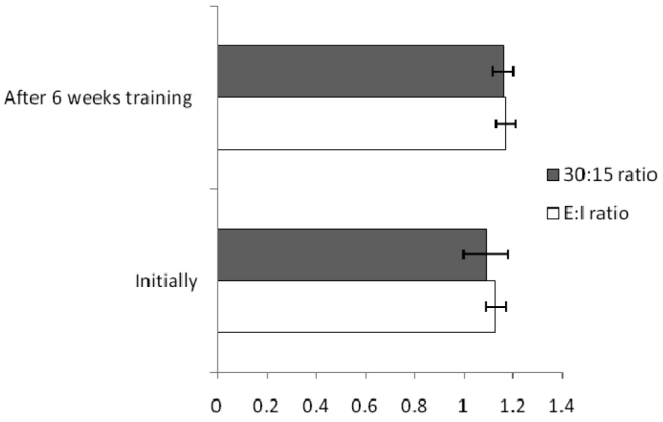
To summarize, the parasympathetic parameters (the deep breathing test and the orthostatic tolerance test) were noted four times in the participants who performed A.N.B.; initially, as a control, after 5 minutes of performing the A.N.B., and then after repeating the same after training for 15 minutes daily, for 6 weeks. The RR intervals of the 15th and the 30th beats were used for the analysis of the 30:15 ratio. The data which was obtained for the above mentioned parameters in both the phases were tabulated and analyzed statistically. 'p-values' of less than 0.05 were taken as significant.

RESULTS

For the participants of the study who performed A.N.B, the control E:I ratio at the start of the study ranged between 1.1 to 1.18, with a mean of 1.13 and an SD of 0.04. The control 30:15 ratio ranged between 1.05 to 1.14, with a mean of 1.09 and an SD of 0.09.These ratios were recorded again after performing A.N.B for 5 minutes. The E:I ratio ranged between 1.08 to 1.5, with a mean of 1.15 and an SD of 0.11. The 30:15 ratio for this group ranged between 1.05 to 1.5, with a mean of 1.12 and an SD of 0.08 [Table/Fig-1]. It was observed that the E:I ratio and the 30:15 ratio had increased after the performance of the alternate nostril breathing for 5 minutes. The changes however, were statistically not significant (p>0.05).

The parasympathetic parameters were reassessed after 6 weeks of the A.N.B. training. The basal E:I ratio of this group ranged between 1.11 to 1.22, with a mean of 1.17 and an SD of 0.04. The basal 30:15 ratio of this group ranged between 1.09 to 1.19, with a mean of 1.16 and an SD of 0.04. The parasympathetic parameters which were recorded after performing A.N.B. for 5 minutes, showed that the E:I ratio in this group ranged between 1.13 to 1.29, with a mean of 1.20 and an SD of 0.04 and that the 30:15 ratio for this group ranged between 1.12 to 1.21, with mean of 1.17 and an SD of 0.03 [Table/Fig-1]. It was observed that after 6 weeks of the A.N.B training, the ratios (the E:I ratio and the 30:15 ratio) had increased after the performance of the A.N.B for 5 minutes, as compared to the basal values. This increase was statistically significant for the E:I ratio (p<0.05), while at the start of this study, it was not so. However, the 30:15 ratio did not show any significant increase after the performance of the A.N.B. for 5 minutes (p<0.05).

When the basal condition which was observed initially in the participants was compared to that which was recorded after 6 weeks of the A.N.B. training [Table/Fig-2], statistically significant increases in the E:I ratio and the 30:15 ratio were observed (p<0.05). A similar comparison of the parameters, which was recorded after 5 minutes of the performance of the A.N.B., initially and after 6 weeks of training , revealed statistically significant increases in the E:I ratio and the 30:15 ratio (p<0.05). Very significant overall increases (p<0.001) were thus observed in the E:I ratio and the 30:15 ratio after the performance of the A.N.B. for 5 minutes, following 6 weeks of training, as compared to the parameters which were observed initially at the start of the study.



[Table/Fig-2]: Comparison of parameters in basal condition initially and after 6 weeks of A.N.B. training (N = 25)
E:I ratio = longest RR interval during expiration/shortest RR interval during inspiration; 30:15 ratio = interval of 15th and 30th beats

DISCUSSION

The normal beat to beat or the R-R interval variation is dependent on the parasympathetic innervations [2]. During a deep inspiration, there is an increase and during a deep expiration, there is a decrease in the heart rate [3]. The result may be expressed as the expiratory: inspiratory ratio, which is the ratio of the mean of the longest R-R intervals during six expirations to the mean of the shortest R-R intervals during six inspirations [1,4]. During an inspiration, the impulses in the vagi, from the stretch receptors in the lungs, inhibit the cardio inhibitory area in the medulla oblongata. The tonic vagal discharge that keeps the heart rate slow decreases and the heart rate increases [3].

The present study relates to ANB and the effects of ANB have been assessed over the activity of the heart by using the non-invasive technique of ECG. The E:I ratio represents the ratio of the RR intervals which was taken during an expiration and an inspiration respectively. The 30:15 ratio is the ratio of the RR interval which was recorded in the standing posture, following the posture from supine. The comparative account of the E:I ratio and the 30:15 ratio in the participants initially and after the performance of the A.N.B for 5 minutes, showed an increase in the E:I and the 30:15 ratios after 5 minutes of the performance of the ANB. This observation suggested a rapid adaptation of the CVS to the alterations in the activity of the respiratory system, which were brought about by the performance of A.N.B for 5 minutes only. The increase in the E:I ratio is interpreted as a decease in the sympathetic activity and an increase in the parasympathetic activity after the performance of the A.N.B. A long-term Alternate Nostril Breathing (ANB) has been shown to enhance the autonomic control of the heart by increasing the parasympathetic modulation [5].

Selvanmurthy et al., suggested a gradual shift of the autonomic equilibrium towards a relative parasympatho dominance due to decreases in the sympathetic activity [6]. Harvey reported that yogic

breathing exercises produced beneficial changes in the mood and in the emotional state. A slower, deeper, and an irregular breathing is associated with a parasympathetic activation [7]. Pal et al., years studied that the regular practice of slow breathing increased the parasympathetic tone and that a decreased sympathetic activity improved the cardiovascular and the respiratory functions [2].

A comparative account of the E:I ratio and the 30:15 ratio at the basal level, at the start of the study and after the practice of A.N.B for 5 minutes, following a training period of 6 weeks, showed that the parasympathetic tone was enhanced significantly in the participants. This was indicated by a significant increase in the E:I ratio in and after the 5 minutes of exercise. These observations and comparisons which were put forth in this study, thus, clearly suggest that the yogic exercise of A.N.B. influences the parasympathetic nervous system significantly.

REFERENCES

[1] Telles S, Joshi M, Somvanshi P. Yoga breathing through a particular nostril is associated with contralateral event-related potential changes. *Int J Yoga*. 2012 Jul; 5(2):102-07.
[2] Pal K, Vekumary S, Madan Mohan. Effect of short term practice of breathing exercises on autonomic functions in normal human. *Indian J Med Res*. 2001; 120:115-21.
[3] Ganong WF. Origin of the heart beat and the electrical activity of the heart. Edn. 22, Mc Graw-Hill, New York 2005; 554-55.
[4] Gautschy B, Weidmann P, Gnadinger MP. Autonomic function tests as related to age and gender in normal man. *Kinische Wochenschrift*. 1986; 64:499-505.
[5] Ghiya S, Lee CM. Influence of alternate nostril breathing on heart rate variability in non-practitioners of yogic breathing. *Int J Yoga.* 2012 Jan; 5(1):66-69.
[6] Selvamurthy W, Nayar HS, Joseph NT, Joseph S. Physiological effects of yogic practice *NIMHANS Journal*. 1983; 1:71-80.
[7] Harvey JR. The effect of yogic breathing exercise on mood. *J Am Soc Psychosomatic Dentistry Med*. 1983; 30:39-48.

AUTHOR(S):
1. Dr. Anant Narayan Sinha
2. Dr. Desh Deepak
3. Dr. Vimal Singh Gusain

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Physiology, VCSG Govt Medical Sciences and Research Institute, Srinagar, Uttarakhand, India.
2. Professor, Department of Physiology, VCSG Govt Medical Sciences and Research Institute, Srinagar, Uttarakhand, India.
3. Associate Professor, Department of Physiology, VCSG Govt Medical Sciences and Research Institute, Srinagar, Uttarakhand, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Desh Deepak,
Department of Physiology,
VCSG Govt Medical Sciences and Research Institute,
Srinagar- 247176, Uttarakhand, India.
Phone: 09410932909
E-mail: deshdeepak_s@rediffmail.com

FINANCIAL OR OTHER COMPETING INTERESTS:
None.

Date of Submission: **Jun 24, 2012**
Date of Peer Review: **Aug 04, 2012**
Date of Acceptance: **Feb 14, 2013**
Date of Publishing: **May 01, 2013**