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Original Research Article

Effect of left & right nostril breathing on R-R interval among adult males – A cross-sectional study

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Abstract

Background: The nasal cycle is an ultradian rhythm with a periodicity of about 2-8 hours, during which the right and left nares are alternately patent. Pranayama, the yogic system of breathing, is based on the belief that right nostril dominance corresponds to sympathetic arousal and left nostril breathing corresponds to parasympathetic arousal. Alternate nostril breathing exercises have been reported to influence cardio-respiratory and autonomic functions. There is a paucity of literature on the effect of breathing through right or left nostril on cardiovascular and autonomic functions. Also the immediate effects of such a maneuver have not been studied. Hence the present study was aimed at analyzing the R-R interval related to left and right nostril breathing and to get a better understanding about the immediate effects of such breathing maneuver on autonomic function.

Materials & methods: 60 healthy adult males between 20-40 years were selected for the study. They were briefed about the breathing maneuver. Subjects were asked to relax completely in supine position for 10 minutes and they were instructed to do right and left nostril breathing for 20 minutes. ECG recording was done during last 5 minutes of different nostril breathing. R-R interval was obtained directly from the computerized ECG system. Students paired t test was done to analyze the statistical significance by using SPSS 17.

Results: The mean (+/-SD) R-R interval with left nostril breathing was 851.77+/-14.45 ms, with right nostril breathing was 826.83 +/- 16.91 ms and both nostril breathing was 828.29+/-133.98 ms. The mean R-R interval between right and left nostril breathing was significantly different (p=0.009).

Conclusion: Parasympathetic activity is increased with left nostril breathing than right and both nostril breathing.

Keywords: nostril breathing; parasympathetic effect, R-R interval

1.Introduction

The nasal cycle has a periodicity of about 2-8 hours, during which the right and left nares are alternately patent.[1] This alternating patency is said to be brought about by the alternating congestion and decongestion of the nasal conchae. The value of the nasal cycle in keeping one nasal cavity active at a time, while providing rest to the other, becomes evident when one considers that the function of the nose is to warm, humidify and filter the nasally inspired air, a process which would lead to the drying of the nasal cavities, and consequently lead to loss of function and make the nasal cavities prone to infections.

It has been shown that the nasal congestion correlates with low sympathetic-high parasympathetic activity, whereas decongestion is directly related to a high sympathetic-low parasympathetic activity mode.[2] It has also been

proposed that the hypothalamus is the centre for the effects of the ANS on the nasal mucosa and the nasal cycle.

Alternate nostril breathing exercises have been found to influence the autonomic nervous system in various ways, such as a decrease in basal sympathetic tone[3], a decrease in heart rate[4], as well as systolic and diastolic blood pressures.[4] It has also been suggested that practiced alternate nostril breathing improves the symptoms and reduces the usage of bronchodilators in asthmatics.[5][6] With practiced alternate nostril breathing, a significant decrease in fasting blood sugar, post prandial blood sugar and glycated hemoglobin and also a significant decrease in triglyceride and low density lipoprotein levels have been reported.[7] In mentally retarded children, after practiced alternate nostril breathing exercises, an improvement in the IQ and social adaptation parameters have been noted.[8] It was also suggested that these exercises led to an increase in the plasticity of motor control.[9]

The short-term effects of alternate nostril breathing maneuvers have been reported as increased galvanic skin resistance, decreased oxygen consumption, decreased heart rate, decreased blood pressure and increased amplitude of theta waves.[10] Practiced single nostril breathing maneuvers have been reported to have various other effects, such as on blink rates[11], intraocular pressure[12]-[16], respiratory rate[17], diastolic blood pressure[17] and heart rate.[18]-[22]

The literature available on the immediate effects of forced single nostril breathing is relatively less. Also not reported are the effects of such a breathing maneuver on R-R interval of the heart. Hence the present study was designed with the purpose of investigating the immediate effects of forced single nostril breathing on R-R interval which would reflect the effects of such breathing maneuvers on heart rate.

2. Material and method

This cross-sectional descriptive study was conducted in the Department of Physiology, P.I.M.S., between January and December 2012. Ethical clearance was obtained from the Institutional Ethics Committee prior to the commencement of the study. The study participants were clinically healthy adult male volunteers in the age group of 20-40 years. The exclusion criteria were as follows:

- Smokers and alcoholics
- Practitioners of yoga
- Participants with any mechanical or infective nasal blockage
- Participants with oro-pharyngeal infections
- Participants on any ANS modifying drugs
- Participants with any major systemic disorders, especially respiratory and cardiovascular disorders

2.1 Methodology

Sixty adult males in the age group of 20-40 years attended the study voluntarily. Prior to being recruited for the study, the participants were briefed about the procedure and written informed consent was obtained from each of them. The study was conducted in a temperature controlled, noise and light reduced laboratory. Recording for each participant was done in the morning hours between 9.00A.M and 11.00 A.M. The participants were instructed to avoid tea, coffee intake and strenuous physical exercise at least 2 hours prior to the test. Each participant reported to the lab after a light breakfast.

In the lab, after preliminary briefing, the participant was asked to lie down in the supine position and breathe in a relaxed manner, without going off to sleep. After a 10 min rest, a 5 min ECG was recorded. This was the first recording for each participant, henceforth designated as BN (to indicate breathing through both nostrils).

Subsequently, the subject was instructed to occlude his left nostril (with his left index finger) and breathe only through his right nostril for the next 20 minutes. Instruction was also given to the participant not to breathe through the mouth. The investigator monitored and ensured that the participants performed this manoeuvre correctly. During the last 5 minutes of this right nostril breathing manoeuvre ECG was recorded as with the BN recording. This was the second recording for each participant, henceforth designated as RN (to indicate right nostril breathing).

The participant was then asked to breathe in a relaxed manner through both nostrils, while resting in the supine position for a period of 10 minutes. Following this period of rest, the participant was asked to occlude his right nostril (with his right index finger) and breathe only through his left nostril for the next 20 minutes. As with the RN manoeuvre, ECG was recorded during the last 5 minutes of this left nostril breathing manoeuvre. This was the third recording for each participant, henceforth designated as LN (to indicate left nostril breathing).

2.2 Equipment and data analysis

ECG recording was done by using limb leads and the electrodes were connected to a computerized ambulatory ECG system - Niviquire, Pune.

The data was statistically analyzed using SPSS version 17. Students paired t test was used.

3. Results

Table 1: Anthropometric Variables

	Mean (n = 60)	SD	Range
Age (yr)	29.85	6.22	20-40
Height (cm)	167.70	6.45	152-180
Weight (kg)	66.52	9.57	40-84
BMI (kg/m^2)	23.58	2.66	17.31-27.85

Table 2: Baseline Vital Parameters

	Mean (n = 60)	SD	Range
Pulse Rate (PR) [bpm]	77.88	6.71	62-88
Systolic BP (SBP) [mm Hg]	117.80	9.72	90-130
Diastolic BP (DBP) [mm Hg]	77.37	5.12	70-88

Table 3: Mean R-R Interval Values with the Three Breathing Manoeuvres

	Mean (ms)	SD	Median (ms)	P value*
Both nostril breathing	828.29	133.98	800.65	0.014 (SS)
Right nostril breathing	826.83	130.96	806.75	
Left nostril breathing	851.77	111.96	849.30	

SS-statistically significant at p=0.05 level

Table 4: Comparison of mean R-R interval values between the different breathing maneuvers

Breathing	P value *	Significance **
Right vs left nostril breathing	0.009	SS
Right vs both nostril breathing	0.87	NS
Left vs both nostril breathing	0.022	NS

p value adjusted for no. of comparisons. SS-statistically significant at p=0.009 level.

4. Discussion

Breathing manoeuvres can be of rapid, slower, relaxed and deep breathing type. Two relaxed breathing manoeuvres have been studied in most investigations: the alternate nostril breathing manoeuvre and the single nostril breathing manoeuvre. Alternate nostril breathing involves inspiring through one nostril, holding the breath and then expiring through the other nostril. The effects of such a breathing manoeuvre, after practice for variable time periods, have been well documented. The immediate effects have also been studied. Alternate nostril breathing has been shown to affect the basal sympathetic tone[3], vagal tone[23], resting heart rate[24], blood pressure[24][25], bronchial tone[26], IQ and social adaptation parameters[27], reaction times[28], glycemic control and lipid profile. [29][30]

Forced single nostril breathing has also been shown to have similar effects, namely on verbal and spatial performances[31], behavior[32], blink rates[11], intra-ocular pressure[12]-[16], respiratory rate[17], blood pressure[17] and heart rate.[18]-[22] The effects of single nostril breathing on HRV has also been studied.[33] However, a search of the literature showed that most of these studies had been conducted after practiced single nostril breathing or in those who were habituated to such manoeuvres. The immediate effects of such breathing manoeuvres, after a single session, have not been reported and thus the purpose of this study was to determine the immediate effects of forced single nostril breathing on R-R interval.

A reduction in heart rate after left nostril breathing has been reported[20], while others have reported no significant changes in the heart rate after left or right nostril breathing.[18][19]

Conversely a study by Dane et al, who made their subjects exercise before studying the effect of nostril breathing on heart rate, found an increase in heart rate with both left nostril and right nostril breathing, probably due to the overall effect of exercise on heart rate.[21]

Jain et al, working with subjects who were asked to practice single nostril breathing reported a drop in heart rate with left nostril breathing in males but not in females.[17]

In our study, the mean R-R interval was highest with left nostril breathing (851.77+/-111.96 ms) and least with right nostril breathing (826.83+/-130.96 ms). When the mean values were compared between the 3 types of breathing, there was a statistically significant difference observed between right and left nostril breathing (p=0.009**). The difference between mean R-R intervals seen with left nostril breathing and both nostril breathing, and that seen between right nostril breathing and both nostril breathing were statistically not significant.

Thus our study goes on to show a significant parasympathetic effect on heart with left nostril breathing as compared to right nostril breathing.

As a treatment option, the advantages of such a manoeuvre are obvious in that it is non-invasive and easy to use by the patient. It will require further investigations to see if the heart-rate-reducing effect of left nostril breathing is as effective in situations of physiological tachycardia, and whether such manoeuvres can be utilized clinically in situations where a prompt reduction in an elevated heart rate is essential for treatment.

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