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The Physiological Responses of Yogic Breathing Techniques: A Case-Control Study

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ABSTRACT

Malik S, Shah M, Hasan S, Bilal M. The Physiological Responses of Yogic Breathing Techniques: A Case-Control Study. **JEPonline** 2011;14(3):74-79. The purpose of this study was to assess the effects of Yogic breathing techniques (Ujjaiya, Bhastrica and Humsa) on heart rate (HR), systolic blood pressure (SBP), and peak expiratory flow rate (PEFR). The Treatment Group consisted of 100 subjects while Control Group consisted of 50 subjects. All subjects signed an informed consent. Physical characteristics (age, height, and weight) were recorded and medical history was obtained from both groups of subjects. The subjects' cardiorespiratory responses were assessed before and after the pranayama (Yogic breathing) session. Yogic breathing techniques were demonstrated and practiced for 1 hr by the Treatment Group under expert guidance, while the Control Group sat quietly. The data were analyzed using SPSS 17 and Student t-tests. When the before and after data were analyzed in each group, the mean values for HR and SBP in the treatment group were significantly decreased after the pranayama session while PEFR was significantly increased. Yogic breathing improved the subjects' cardiorespiratory responses in the Treatment Group. Further study is required to understand how long the positive hemodynamic responses continue to produce positive health benefits, and the degree to which individuals with hypertension and asthma will benefit from Yogic breathing.

Key Words: Pranayama, Blood pressure, Heart Rate, Peak Expiratory Flow Rate

INTRODUCTION

Yoga is a science practiced all over the world. It is an alternate form of physical activity that has been widely studied for its effects on human health (1,2). The word “yoga” itself is derived from the Sanskrit word meaning "union," which is a philosophy that connects the body, breath, and mind to maintain energy balance. Therapeutic yoga involves various physical asanas (postures), breathing exercises, and meditation that helps improve the general well-being of the individual. Moreover, it has shown to produce consistent physiological changes that have sound scientific basis (8).

Scientists who have extensively studied yoga state that it increases longevity (8,12,17,21) and has therapeutic (3,11,13,22) as well as rehabilitative effects (4,14,22). It has also been seen as an attractive alternate to conventional aerobic and power training programs as it requires very little space, almost no equipment and has no detrimental side effects (5,13,19,20) and, with its primary focus on relaxation, body awareness, and meditation, it provides a qualitatively diverse exercise experience which may be perceived as less demanding and more gratifying. Yoga with its distinct characteristics satisfies many of the conditions which have been shown to be strongly associated with participation in physical activity, such as low perceived hindrance to participation (18), being pleasant (18), and having a low-to-moderate stress intensity (23).

Although yoga has received extensive amount of study regarding its significant cardiorespiratory, musculoskeletal, and metabolic health effects (7), studies on Yogic breathing in Pakistan are still lacking. Hence, the current study was undertaken to assess the effects of meditation on heart rate (HR), systolic blood pressure (SBP) and peak expiratory flow rate (PEFR).

SUBJECTS and METHODS

The present study was undertaken at Creative Dimensions (a yoga and meditation training center) in Lahore, Pakistan. One hundred subjects performed yoga Pranayamas (breathing techniques) and Savasana (meditation) for 3 months (i.e., the Treatment Group). The Control Group consisted of 50 subjects from the non-teaching members of Combined Military Hospital (CMH), Lahore Medical College. None of the subjects in the Control Group was performing Yoga or any other physical activity on a regular basis. Informed consent was obtained at the time of induction into the study. All subjects were non-alcoholic and non-smokers. They were not taking any drugs, and they had similar dietary habits as well as physical and mental activities at work and home. None of the subjects had any physical abnormalities. All procedures were reviewed and approved by the Internal Review Board, CMH Lahore Medical College.

Initially, the subjects performed a 30-min resting period during which they were seated comfortably to complete a general physical examination and subject history forms. Resting data were obtained from all the subjects. This procedure included: (1) name, age, sex, height, and weight of the subject; (2) asking the subject to relax in the sitting position for 5 min. Then, resting heart rate (HR) was taken for 1 min; (3) blood pressure was then measured at the 15-min interval and averaged using a Mercury Sphygmomanometer by the auscultatory method; and (4) peak expiratory flow rate (PEFR) was measured with a standard Peak Expiratory Flow Meter.

After recording of the cardiorespiratory responses, the subjects were given instructions for carrying out the yogic breathing techniques under expert guidance. The breathing techniques used in particular were Bhshtheshtrica and ujja followed by Humsaa. The session lasted for 1 hr and included 3 cycles of bhshtheshtrica which consisted of 8 breaths per cycle. The Ujja technique lasted for 30

min and consisted of 7 breaths for each posture, three different postures were used including both hands being placed on the sides, on the armpits as well as on the back. This was followed by the Humsaa technique of breathing in which the subject sat in the squat position (sukhasana or easy pose) with a straight back and chants the word "Humsaa", inhaling on the syllable "hum" and exhaling on "saa." The subjects of the control group were asked to sit in the squat position. They were told to allow the free flow of thoughts in their mind during the parallel 1 hr meditation session. After the completion of the meditation session, the same cardiorespiratory responses were measured and recorded.

Statistical Analyses

The data were analyzed using Statistical Package for Social Sciences 17.0 for Windows (SPSS, Inc., Chicago, IL, USA). Analysis of the physical characteristics and cardiorespiratory responses were carried out using descriptive statistics. Physical characteristics and differences in mean values for resting HR, SBP, DBP and PEFR for the study population were subjected to the Student's t test. A P value of .05 was considered significant.

RESULTS

Hundred subjects participated in the Treatment Group while 50 subjects formed the Control Group. Out of the Treatment Group females were 72% and males were 28%. In the Control Group, males were 48% and females were 52%. There were no statistical differences in age, height, or weight between the subjects of the two groups (Table 1).

Table 1. Physical characteristics of the subjects in each group.

Physical Characteristics	Treatment Group (Mean ± SD) N = 100 (72 males 28 females)	Control Group (Mean ± SD) N = 50 (24 males 26 females)	t value	P value
Age (yr)	26 ± 8.0	27 ± 6.6	0.751	0.46
Height (cm)	162.2 ± 6.6	162.7± 6.3	0.94	0.36
Weight (kg)	67.1 ±14.6	66.3 ± 13.3	-0.47	0.64

DISCUSSION

When compared to the Control Group, the Treatment Group showed that the mean values for HR, SBP, and DBP were significantly decreased while PEFR was significantly increased. Clearly, there was a significant improvement in the hemodynamic responses of the subjects in the Treatment Group following the practice of Yogic breathing techniques (refer to Table 2). This finding is in accordance with earlier studies on short-term effects of yoga on the cardiorespiratory system (6,9,11,16). It is reasonable to conclude that the decrease in HR after the practice of yoga is directly related to an increase in vagal tone and a corresponding decrease in sympathetic activity (10,24,25). Also, the decrease in sympathetic activity leads to a decrease in the secretion of catecholamines which allows for vasodilatation and hence improves peripheral circulation in the body.

Table 2. The hemodynamic responses of the subjects in each group.

Variables	Treatment Group (Mean ± SD)		Control Group (Mean ± SD)	
	Before	After	Before	After
HR (beats·min^{-1}) *	83.6 ± 11.1	72.4 ± 11.4	80.4 ± 8.9	80.3 ± 8.6
SBP (mmHg) *	127.7 ± 9.2	119.1 ± 8.8	123.3 ± 5.9	123.4 ± 6.1
DBP (mmHg)	81.9 ± 8.8	80.0 ± 7.1	81.1 ± 7.9	80.9 ± 7.3
PEFR (L·min^{-1}) *	346.8 ± 113.5	402.8 ± 105.2	384.6 ± 111.7	385.8 ± 111.7

HR = heart rate; SBP = systolic blood pressure; DBP = diastolic blood pressure; PEFR = peak expiratory flow rate. *Significant (P = 0.0001) between before and after in the Treatment Group. No significant differences between before and after in the Control Group.

The practice of Yogic breathing has been shown to decrease resting oxygen consumption (10), which is likely the reason for the decrease in HR in the Treatment Group. The HR response is indicative of an overall decrease in the work of the heart and, therefore, one would expect a decrease in SBP as well. It is well-known that the practice of yoga alters hypothalamic discharges (25) resulting in a decrease in sympathetic tone and peripheral resistance; both physiological responses lead to a decrease DBP. In addition, Yogic breathing has been shown to strengthen the respiratory muscles, thus increasing the excursions of the diaphragm and lungs along with increased thoracic compliance (9,15,16,24,25). Apart from this, yoga practice decreases airway resistance (15). All these factors may contribute to the increase in PEFR as was observed in the Treatment Group. Lack of generalization of the results is one of the limitations of this study. Since this study was carried out at one yoga center based in Lahore, differences in demographic variables, location, and subject characteristics may affect the results when applied to another yoga center. Future studies should be carried out at various locations with a larger sample size to validate the findings in the current study.

CONCLUSIONS

This study showed that short-term yoga practice (breathing meditation) significantly improves the cardiorespiratory system at rest. Hence, it seems clear that by decreasing HR and SBP by way of breathing meditation, the work of the heart (i.e., myocardial oxygen consumption, MVO_2) is decreased as well. This is a very positive physiologic finding in that it mirrors the effects of specific heart drugs without the side effects. Further research with a larger sample size is recommended for applying these results to the population in general.

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