



EFFECT OF PRANAYAM ON BREATH HOLDING TIME IN HEALTHY YOUNG ADULTS

Anatomy

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ABSTRACT

This before-and-after type of study (without controls) was conducted at a teaching hospital in Western India to study of effect of pranayam on breath holding in healthy young adults, of either gender. After explaining the study to the prospective participants and obtaining their written informed consent, baseline information of participants, including pre-test values of breath holding time, was recorded. After eight weeks of pranayam exercises, post-test values were obtained. The mean age of the female participants (n=30) was 18.60 $\pm$ 0.72 years while that for males (n=30) was 18.80 $\pm$ 0.76 years. The pre- and post-pranayam differences in pulse rate and oxygen saturation were not significant, but that for breath holding time was highly significant for both females (paired t-value=10.617; df=58; p<0.0001) and males (paired t-value=6.751; df=58; p<0.0001). Pranayam is a non-pharmacological method and may be used as an adjunct in treatment of lung diseases with impaired pulmonary

KEYWORDS

Breath holding time, Lung functions, Pranayam

INTRODUCTION

“Yoga” connotes union of mind, body and spirit. [1] “Prana” refers to the life force or life energy; “Yama” implies discipline or control and “Ayama” is expansion or extension. “Pranayam” (meaning “control of prana”) attempts to use breathing techniques to influence the body-mind constellation of energy. [2] Pranayama harmonizes the sympathetic and parasympathetic nervous system, facilitates dilatation of the bronchi by rectifying abnormal breathing patterns and reducing the tone of respiratory muscles, [3-5] improves the strength of expiratory as well as inspiratory muscles, [6] and helps in elimination of secretions from bronchial tree, which makes room for more air. [7]

Regular practice of pranayama, which involves voluntary control of inhalation and exhalation, can help regulate other physiological functions. [8] The effect of various pranayamas on healthy individuals, [7] patients, [9-11] with its therapeutic [12] and rehabilitative effects [13] has been reported.

The objective of this study was to study of effect of pranayam on breath holding time in healthy young adults, aged 18-25 years, of either gender.

MATERIALS AND METHODS

This before-and-after type of study (without controls) was conducted at a teaching hospital in Western India. The participants included healthy young adults aged 18-25 years, of either gender, who had never undergone yoga or pranayam training and gave written informed consent for participation. Those who had undergone yoga or pranayam training in the past, those who did not give written informed consent for participation and those with self-reported health problems were excluded.

After obtaining prior approval from institutional authorities and the Institutional Clinical Ethics Committee, the study was explained to the prospective participants and their written informed consent was obtained. Baseline information of participants, including pre-test values of breath holding time, was recorded. Health and Yoga Deep Breathing Exercise Measurement System (Soul Genie Pathways LLP, Noida, UP, India) was used to analyze the breath holding time. Finger tip pulse oximeter (Nureca Inc, New York, NY, USA) was used to measure pulse rate and oxygen saturation. The pranayam exercises were imparted to the participants by a trained yoga instructor. After eight-week period, post-test values were obtained.

The data were entered in Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA) and analyzed using SPSS statistical software Windows Version 25.0 (IBM Corporation, Armonk, NY, USA). Continuous data were presented as mean $\pm$ standard deviation. The 95% confidence interval (CI) was presented as: [Mean - (1.96) * Standard Error] to [Mean + (1.96) * Standard Error]. The standard error of difference between two sample means and paired t-test values were calculated. The statistical significance was determined at p<0.05.

RESULTS AND DISCUSSION

A total of 60 persons (30 females and 30 males) participated in the study. The mean age of the female participants (n=30) was 18.60 $\pm$ 0.72 years (95% CI: 18.34 – 18.86 years), while that for their male counterparts (n=30) was 18.80 $\pm$ 0.76 years (95% CI: 18.53 – 19.07 years). The gender difference in age distribution was not significant (Z=1.046; p=0.295). The mean height of the females was 160.79 $\pm$ 6.62 cm (95% CI: 158.42 – 163.17 cm), while that for males was 174.84 $\pm$ 9.01 cm (95% CI: 171.61 – 178.07 cm). The mean weight of the females and male participants was 54.68 $\pm$ 6.88 Kg (95% CI: 52.22 – 57.15 Kg) and 68.57 $\pm$ 11.94 Kg (95% CI: 64.29 – 72.85 Kg), respectively.

In the pre-pranayam phase, the mean pulse rate of the females was 84.57 $\pm$ 10.73 beats per minute (95% CI: 80.72 – 88.41 beats per minute), while that for males was 79.30 $\pm$ 10.76 beats per minute (95% CI: 75.45 – 83.15 beats per minute). After eight weeks of pranayam exercise, the mean pulse rate of the females was 85.03 $\pm$ 7.22 beats per minute (95% CI: 82.45 – 87.62 beats per minute), while that for males was 87.10 $\pm$ 7.69 beats per minute (95% CI: 78.94 – 84.46 beats per minute). However, the pre- and post-pranayam difference in pulse rate was not significant for females (paired t-value=0.104; df=58; p=0.846) and males (paired t-value=0.993; df=58; p=0.324). (Table-1)

For females, the mean oxygen saturation marginally increased from 98.60 $\pm$ 0.77% (95% CI: 98.32 – 98.88%) in the pre-pranayam phase to 98.73 $\pm$ 0.69 (95% CI: 98.49 – 98.98%) after eight weeks of pranayam exercise, while that for males marginally increased from 98.03 $\pm$ 1.81% (95% CI: 97.38 – 98.68%) to 98.30 $\pm$ 1.90% (95% CI: 97.62 – 98.98%) in the respective phases. But, the pre- and post-pranayam difference in oxygen saturation was not significant for females (paired t-value=0.688; df=58; p=0.493) and males (paired t-value=0.563; df=58; p=0.575). (Table-1)

Table-1: Physiological parameters before pranayam and after 8 weeks of pranayam

Parameter		Females (n=30)		Males (n=30)	
		Before	After	Before	After
Pulse rate (beats/min)	Mean	84.57	85.03	79.30	81.70
	SD	10.73	7.22	10.76	7.69
	Paired t	0.194		0.993	
	'p' value	0.846		0.324	
Oxygen saturation (%)	Mean	98.60	98.73	98.03	98.30
	SD	0.77	0.69	1.81	1.90
	Paired t	0.688		0.563	
	'p' value	0.493		0.575	
Breath holding time (sec)	Mean	4.63	12.47	9.43	16.17
	SD	2.31	3.32	4.25	3.44
	Paired t	10.617		6.751	
	'p' value	<0.0001 *		<0.0001 *	

SD = Standard deviation; *Significant

Breath holding time:

The mean breath holding time showed a drastic increase from 4.63 +/- 2.31 seconds (95% CI: 3.81 – 5.46 seconds) in the pre-pranayam phase to 12.47 +/- 3.32 seconds (95% CI: 11.28 – 13.66 seconds) after eight weeks of pranayam exercise. A similar increase was found in males, from 9.43 +/- 4.25 seconds (95% CI: 7.91 – 10.96 seconds) in the pre-pranayam phase to 16.17 +/- 3.44 seconds (95% CI: 14.93 – 17.40 seconds) after eight weeks of pranayam exercise. The pre- and post-pranayam difference in breath holding time was highly significant for both females (paired t-value=10.617; df=58; p<0.0001) and males (paired t-value=6.751; df=58; p<0.0001).

In the pre-pranayam phase, a large gender difference was observed in the maximum, third quartile, median, first quartile and the minimum breathholding time. After eight weeks of pranayam exercise, the minimum breath holding time was 10 seconds and the first quartile was 12 seconds for both female and male participants (Fig-1).

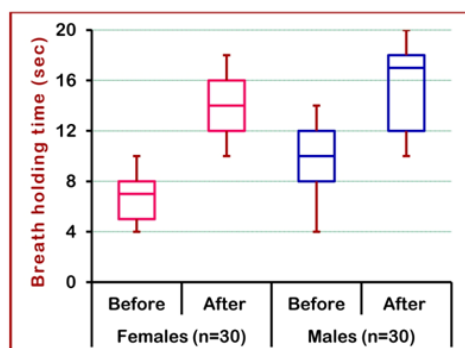


Fig-1: Breath holding time before and after 8 weeks of pranayam exercise

Statistically significant increase in breath holding time after pranayama practice has also been reported by other researchers. [14, 15] Slow and prolonged inspiration and expiration during the process of pranayam stretches elastin and collagen fibres in the lung parenchyma. [16] Lung inflation stimulates the release of lung surfactant into alveolar spaces, which increases the lung compliance. [17] Prolonged and regular inspiration and expiration acclimatizes the central and peripheral chemoreceptors for hypercapnoea and hypoxia. [18]

CONCLUSION

This study showed a significant increase in breath holding time after eight weeks of pranayam, which may be recommended as a non-pharmacological prophylactic method for improving pulmonary functions in order to avert possible respiratory diseases in future. Pranayam may also be used as an adjunct in treatment of lung diseases with impaired pulmonary functions.

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