IMPACT OF SHORT-TERM BHASTRIKA PRANAYAMA ON RESPIRATORY PARAMETERS: AN ANCIENT PRACTICE WITH CONTEMPORARY SIGNIFICANCE

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Abstract. *Purpose:* The study was conducted to determine the impact of short-term bhasrika pranayama on respiratory parameters. *Material:* The research was carried out on a sample of 30 university level girls. Experimental group was subjected to 4-week training of bhasrika pranayama. *Statistical Analysis:* Student t test was utilized for analysis of data. *Results:* The Mean and Standard Deviation values of Tidal Volume (VT) of pre-test and post-test of experimental group was 389.60 ± 10.25 and 408.40 ± 27.44 respectively. However, the Mean and Standard Deviation values of Tidal Volume of pre-test and post-test of control group were 352.93 ± 8.80 and 351.40 ± 9.83 . The t-value in case of experimental group was 2.8976 and for control group it was 1.3580. *Conclusions:* The significant differences were noted in Tidal Volume, Expiratory Reserve Volume, Inspiratory Reserve Volume, Vital Capacity and Inspiratory Capacity in the experimental group. However, insignificant changes over that 4-week period were noted in the control group.

Keywords: tidal volume, expiratory reserve volume, inspiratory reserve volume, vital capacity, inspiratory capacity.

Introduction

Yoga techniques yield incredible physiological variations and have comprehensive methodical basis [6, 11]. Yoga & pranayam is an antique practice practiced by mentors and yogis as an enviable and vivacious way of life. Pranayam, the fourth step of ashtang yoga is an important component of yoga training [6]. The precise significance of yoga is to attain stability within the inner and peripheral atmosphere, thus looking for intellectual, divine and bodily health. This is probable through the exercise of "Pranayama", [10]. The exercise of yoga leads to a decrease in respiratory rate and calming of the mind, which leads to reduced arousal condition [7, 8]. But various studies show that respiratory parameters improve after yoga & pranayama. Significant increase in the VC, V_T increase in ERV & IC and breath holding time is observed [2, 9]. Growing number of evidences have claimed that yoga practices increases longevity, [1] has therapeutic [4] and rehabilitative effects [3]. Consequently, a yoga practitioner, through the technique of pranayama, can at some stage control other physiological functions and finally control manifestation of prana even outside the body [12]. The effect of different pranayamas on healthy [13] and diseased people [14, 15 and 16] has been well studied and they are known to affect the cardiopulmonary activities and autonomic functions. Growing number of evidences have claimed that yoga practices increases longevity, [17] has therapeutic [18] and rehabilitative effects [19, 20].

Methods

Subjects

For the purpose of the current investigation, thirty, university level girls of 21-26 years were selected. Subjects were purposively divided into 2 groups: Group-A: Experimental ($n_1=15$); Group-B: Control ($n_2=15$).

Table 1

Distribution and Demographics of Subjects

Sample Size (N=30)			
Variables	Total (N=30)	Experimental group ($n_1=15$)	Control group ($n_2=15$)
Age	22.00 ± 1.93	21.67 ± 1.95	22.33 ± 1.91
Body Height	5.49 ± 0.19	5.533 ± 0.19	5.46 ± 0.18
Body Mass	61.14 ± 3.85	61.00 ± 3.38	59.29 ± 4.21

Methodology

This study is designed as a retrospective cross-sectional study. The experimental group was subjected to 4-week training of bhasrika pranayama. The following indices were measured:

- Tidal volume (V_T)
- Expiratory Reserve Volume (ERV)
- Inspiratory Reserve Volume (IRV)
- Vital Capacity (VC)
- Inspiratory Capacity (IC)

The details of training program are brought forth in table-1.

Fig. 1. Study Design

Fig. 2. Subjects Performing Tidal Volume (V_T)

Fig. 3. Subjects Performing Expiratory Reserve Volume (ERV)

Fig. 4. Subjects Performing Inspiratory Reserve Volume (IRV)

Fig. 5. Subjects Performing Vital Capacity (VC)

Fig. 6. Subjects Performing Inspiratory Capacity (IC)

Table 2

Experimental Treatment			
4-Weeks			
Bhastrika Pranayama Training Programme			
Weeks	Schedule	Time	Duration
1 st Week	Preliminary Yogic Exercises	5 Minute	20 Minute
	Practice of Bhastrika Pranayama (9 Rounds X 1 Set)	10 Minute	
	Relaxation Posture	5 Minute	
2 nd Week	Preliminary Yogic Exercises	5 Minute	25 Minute
	Practice of Bhastrika Pranayama (9 Rounds X 2 Set)	15 Minute	
	Relaxation Posture	5 Minute	
3 rd Week	Preliminary Yogic Exercises	5 Minute	30 Minute
	Practice of Bhastrika Pranayama (9 Rounds X 3 Set)	20 Minute	
	Relaxation Posture	5 Minute	
4 rd Week	Preliminary Yogic Exercises	5 Minute	35 Minute
	Practice of Bhastrika Pranayama (9 Rounds X 4 Set)	25 Minute	
	Relaxation Posture	5 Minute

Fig. 7. Subjects Performing Bhastrika Pranayama

Statistical Analyses

Student t test was utilized for analysis of data. The level of significance was set at 0.05.

Results

The results of Respiratory Parameters are brought forth in table-3-7.

Table 3

Tidal Volume (V_T)						
<i>Group</i>	<i>Number</i>	<i>Mean</i>	<i>SD</i>	<i>SEM</i>	<i>t-value</i>	<i>p-value</i>
Experiment (Pre-test)	15	389.60	10.25	2.65	2.8976*	0.011
Experimental (Post-test)	15	408.40	27.44	7.08		
Control (Pre-test)	15	352.93	8.80	2.27	1.3580	0.195
Control (Post-test)	15	351.40	9.83	2.54		

Tidal Volume (V_T)

The Mean and Standard Deviation values of Tidal Volume (V_T) of pre-test and post-test of experimental group was 389.60 ± 10.25 and 408.40 ± 27.44 respectively. However, the Mean and Standard Deviation values of Tidal Volume (V_T) of pre-test and post-test of control group were 352.93 ± 8.80 and 351.40 ± 9.83 . The t-value in case of experimental group was 2.8976* and for control group it was 1.3580.

Significant between-group differences were noted in Tidal Volume (V_T) since the calculated value of ($t=2.8976^*$) is greater than tabulated value of $t_{.05} (14) = 2.14$ for the selected degree of freedom and level of significance.

Fig. 8. Descriptive Statistics of Tidal Volume (V_T) of (a) Experimental (Pre & Post) and (b) Control (Pre & Post) group of University Level Girls.

Table 4

Descriptive Statistics and Paired Sample t-test of Expiratory Reserve Volume (ERV) of University Level Girls

Expiratory Reserve Volume (ERV)						
<i>Group</i>	<i>Number</i>	<i>Mean</i>	<i>SD</i>	<i>SEM</i>	<i>t-value</i>	<i>p-value</i>
Experiment (Pre-test)	15	846.80	22.08	5.70	6.8739*	0.0001
Experimental (Post-test)	15	859.40	17.70	4.57		
Control (Pre-test)	15	756.13	31.31	8.08	1.0473	0.3127
Control (Post-test)	15	762.13	20.73	5.35		

Expiratory Reserve Volume (ERV)

The Mean and Standard Deviation values of Expiratory Reserve Volume (ERV) of pre-test and post-test of experimental group was 846.80 ± 22.08 and 859.40 ± 17.70 respectively. However, the Mean and Standard Deviation values of Expiratory Reserve Volume (ERV) of pre-test and post-test of control group were 756.13 ± 31.31 and 762.13 ± 20.73 . The t-value in case of experimental group was 6.8739* and for control group it was 1.0473.

Significant between-group differences were noted in Expiratory Reserve Volume (ERV) since the calculated value of ($t=6.8739^*$) is greater than tabulated value of $t_{.05} (14) = 2.14$ for the selected degree of freedom and level of significance.

Fig. 9. Descriptive Statistics of Expiratory Reserve Volume (ERV) of (a) Experimental (Pre & Post) and (b) Control (Pre & Post) group of University Level Girls

Table 5

Descriptive Statistics and Paired Sample t-test of Inspiratory Reserve Volume (IRV) of University Level Girls

Inspiratory Reserve Volume (IRV)						
Group	Number	Mean	SD	SEM	t-value	p-value
Experiment (Pre-test)	15	2345.47	23.86	6.16	6.0502*	0.0001
Experimental (Post-test)	15	2360.00	18.35	4.74		
Control (Pre-test)	15	2223.07	29.12	7.52	0.666	0.516
Control (Post-test)	15	2228.67	12.26	3.17		

Inspiratory Reserve Volume (IRV)

The Mean and Standard Deviation values of Inspiratory Reserve Volume (IRV) of pre-test and post-test of experimental group was 2345.47 ± 23.86 and 2360.00 ± 18.35 respectively. However, the Mean and Standard Deviation values of Inspiratory Reserve Volume (IRV) of pre-test and post-test of control group were 2223.07 ± 29.12 and 2228.67 ± 12.26 . The t-value in case of experimental group was 6.0502* and for control group it was 0.666.

Significant between-group differences were noted in Inspiratory Reserve Volume (IRV) since the calculated value of ($t=6.0502^*$) is greater than tabulated value of $t_{0.05} (14) = 2.14$ for the selected degree of freedom and level of significance.

(b)

Fig. 10. Descriptive Statistics of Inspiratory Reserve Volume (IRV) of (a) Experimental (Pre & Post) and (b) Control (Pre & Post) group of University Level Girls

Table 6.

Descriptive Statistics and Paired Sample t-test of Vital Capacity (VC) of University Level Girls						
Vital Capacity (VC)						
Group	Number	Mean	SD	SEM	t-value	p-value
Experiment (Pre-test)	15	3581.80	26.24	6.78	7.0889*	0.0001
Experimental (Post-test)	15	3626.47	42.63	11.01		
Control (Pre-test)	15	3334.80	40.08	10.35	0.717	0.4851
Control (Post-test)	15	3342.33	26.23	6.77		

Vital Capacity (VC)

Mean and Standard Deviation values of Vital Capacity (VC) of pre-test and post-test of experimental group was 3581.80 ± 26.24 and 3626.47 ± 42.63 respectively. However, Mean and Standard Deviation values of Vital Capacity (VC) of pre-test and post-test of control group were 3334.80 ± 40.08 and 3342.33 ± 26.23 . The t-value in case of experimental group was 7.0889* and for control group it was 0.717.

Significant between-group differences were noted in Vital Capacity (VC) since the calculated value of ($t=7.0889^*$) is greater than tabulated value of $t_{0.05} (14) = 2.14$ for the selected degree of freedom and level of significance.

(a)

(b)

Fig. 11. Descriptive Statistics of Vital Capacity (VC) of (a) Experimental (Pre & Post) and (b) Control (Pre & Post) group of University Level Girls

Table 7

Descriptive Statistics of Inspiratory Capacity (IC) of University Level Girls						
Inspiratory Capacity (IC)						
Group	Number	Mean	SD	SEM	t-value	p-value
Experiment (Pre-test)	15	3971.40	30.64	7.91	3.4908*	0.003
Experimental (Post-test)	15	4057.60	98.08	25.33		
Control (Pre-test)	15	3687.73	42.65	11.01	0.605	0.554

Control (Post-test)	15	3693.80	32.34	8.35		
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Inspiratory Capacity (IC)

Mean and Standard Deviation values of Inspiratory Capacity (IC) of pre-test and post-test of experimental group was 3971.40 ± 30.64 and 4057.60 ± 98.08 respectively. However, the Mean and Standard Deviation values of Inspiratory Capacity (IC) of pre-test and post-test of control group were 3687.73 ± 42.65 and 3693.80 ± 32.34 . The t-value in case of experimental group was 3.4908* and for control group it was 0.605.

Significant between-group differences were noted in Inspiratory Capacity (IC) since the calculated value of ($t=3.4908^*$) is greater than tabulated value of $t_{0.05} (14) = 2.14$ for the selected degree of freedom and level of significance.

(a)

(b)

Fig. 12. Descriptive Statistics of Inspiratory Capacity (IC) of (a) Experimental (Pre & Post) and (b) Control (Pre & Post) group of University Level Girls

Conclusions:

Based on the analysis of the results obtained, we conclude that the significant differences were noted in (V_T), (ERV), (IRV), (VC) and (IC) in the experimental group. However, no significant changes over that 4- week period were noted in the control group.

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