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Effect of Bhastrika Pranayama on Respiratory Variables

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Abstract

The aim of this research was to see how Bhastrika pranayama affected respiratory measures, including PFT (pulmonary function test), FEV1/FVC (forced expiratory volume/forced vital capacity), and PEFR (peak expiratory flow rate). The individuals for the current study were chosen from the Banaras Hindu University in Varanasi to evaluate the respiratory parameters following an eight-week practice of Bhastrika pranayama. Thirty people were chosen from two groups (the experimental and control groups). The volunteers for this study varied in age from 22 to 28 years old. For the purpose of statistical analysis, ANCOVA was used. And it is concluded that Bhastrika pranayama therapy was helpful in bringing about changes in PFT (pulmonary function test), FEV1/VFC, and PEFR during an eight-week period.

Introduction

Yoga is a collection of physical, mental, and spiritual practices that originated in ancient India. Yoga is one of the six mainstream Hindu philosophical systems [2,3]. In Hinduism, Buddhism, and Jainism, there are several yoga schools, practices, and aims [1,4]. Pranayama is a Sanskrit term that means "extension of the praa (breath or life force)" or "breath control" [5,6]. The word is made up of two Sanskrit words: prana, which means life force (especially the breath), and either Ayama (to restrain or control the prana, implying a set of breathing techniques in which the breath is intentionally altered to produce specific results) or the negative form Ayama, which means to extend or draw out (as in life force extension) [7,8].

Pranayama is interpreted as "trance induced by stopping all breathing" in the Bhagavad-Gita as It Is and is derived from two independent Sanskrit terms, praa and Ayam [10].

Pranayama is the conscious awareness of one's breath, which is the life energy that both energizes and calms the body. The phrase is derived from the Sanskrit words prana, which means "life force," and ayama, which means "extension." Pranayama is an essential component of yoga [9].

Pranayama is a Sanskrit word alternatively translated as "extension of the praṇa (breath or life). This technical definition refers to a particular system of breath control with three processes as explained by Bhattacharyya purak [11]. The word “Bhastrika Pranayama” comes from the Sanskrit word Bhastrika, which means breathing like a bellows. Bellows is a device for producing a strong current of air which was used to fan the fire in Ancient days. In Bhastrika Pranayama our lungs are moved with movements that are very much similar to the bellows [12,13]. Hence the Bhastrika Pranayama is called the ‘bellows breath’. Bhastrika (bellow-breathing) is a powerful and energetic Pranayama in yoga breathing exercises [15]. In Ancient yogis, they called this breathing exercise as “the yoga breath of fire”. If you did Kapal-bhati Pranayama, in this the importance is only on exhalation which is forced, short and quick [14]. In Kapal-bhati Pranayama, inhalation is passive and natural. During exhalation, we also force the belly in toward our spine in a brisk movement.

While in the Bhastrika Pranayama Inhalation and exhalation both are forced. The movement of the belly along with every breath is an optional variation. So Bhastrika Pranayama is all about inhaling and exhaling completely so that our body gets a sufficient amount of oxygen [16].
There are two different techniques for Bhastrika Pranayama. One is predicated on the classical approach given within the Hatha yoga Pradipika. The other is a modern and changed version of the technique and involves the movement of the arms and shoulders alongside the breath. Here we described the Bhastrika Pranayama according to "Hatha Pradipika".

Delimitations

The study was delimited to 30 subjects out of whom 15 subjects were selected for the experimental group whereas 15 subjects were selected for the controlled group.
The age of the subjects was ranged between 22-28 Years.
The Study was further delimited to the training Bhastrika Practice for 8 Weeks.
The study was also delimited to the following dependent respiratory variables:
Pulmonary Function Test (PFT)
Forced expiratory Volume / Forced Vital Capacity (FEV1/FVC)
Peak Expiratory Flow Rate (PEFR)

PROCEDURE AND METHODOLOGY

Selection of Subjects

The subjects for the present study were selected from the Banaras Hindu University, Varanasi. Total 30 subjects were selected, out of which 15 subjects experimental group and 15 under the control group. The age of the subjects for the present study was ranged from 22 to 28 years. Before the selection of subjects, they were asked and requested to be the active subject as all students were was required to take part in the study actively.

Selection of Variables

Keeping the feasibility criterion in mind, the research scholar has selected the following variables:
Dependent Variables:

1. Pulmonary Function Test (PFT)
2. Forced expiratory Volume / Forced Vital Capacity (FEV1/FVC)
3. Peak Expiratory Flow Rate (PEFR)

Independent Variable:

- Bhastrika pranayama Training

Criterion Measures

The following Criterion measures were adopted for the present study.

Table-l: Criterion measures for testing

S.N.	Name of Test	Purpose	Tools/Test/Equipment used	Unit
1.	Pulmonary Function Test (PFT)	To estimate Lungs capacity/ lungs function	Computerize	CC/Ltr.

2.	Forced expiratory Volume / Forced Vital Capacity (FEV1/FVC)	To estimate Lungs capacity/ lungs function	Computerize	%
3.	Peak Expiratory Flow Rate (PEFR)	To estimate Lungs capacity/ lungs Function	Computerize	%

Table -2: Schedule of Training

Sr. No.	Training	Resting Time
1.	10 strokes	1 Minute Savasana
	10 strokes	
	10 strokes	
2	15 Strokes	1 Minute Savasana
	15 Strokes	
	15 Strokes	
3	20 Strokes	1 Minute Savasana
	20 Strokes	
	20 Strokes	
4	25 Strokes	1 Minute Savasana
	25 Strokes	
	25 Strokes	
5	30 Strokes	1 Minute Savasana
	30 Strokes	
	30 Strokes	
6.	35 Strokes	1 Minute Savasana
	35 Strokes	
	35 Strokes	
7.	40 Strokes	5 Minute Savasana
	40 Strokes	
	40 Strokes	

Experimental Design

Pre- test post-test randomized group design was used for the present study. A test was administered at an interval of 8 weeks. The pre-tests were taken prior to the Bhastrika treatment and post-test was taken after 8 weeks of Bhastrika pranayama treatment.

Collection of Data

Data was collected two times in the interval of 8 weeks of Bhastrika practices. Data was collected prior to the treatment in the form of pre- test & after 8 weeks of Bhastrika practices; in the form of post-test.

Administration of test

1. Pulmonary Function Test (PFT) - Computerize
2. Forced expiratory Volume / Forced Vital Capacity (FEV1/FVC) - Computerize
3. Peak Expiratory Flow Rate (PEFR) – Computerize

Statistical Technique

The data was analysed by applying Analysis of Co-Variance (ANCOVA) Technique to find out the effect of Bhastrika Pranayama on Respiratory Variables of the subjects. The level of significance was set at 0.05.

Statistical Analysis of the Data

The result pertaining to descriptive statistics and analysis of covariance between experimental and control group of selected respiratory parameters are presented in below tables.

PFT

Table no. – 3: Descriptive statistics of experimental group during post testing in relation to PFT.

Group	Mean	Std. Deviation	N
Control	2.8120	.48082	15
Experimental	3.0647	.46234	15
Total	2.9383	.48095	30

Table no. – 3.1: Descriptive statistics for the data measured in post testing after adjustment with the initial difference in relation to PFT are shown in table no 1.2

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	2.267a	.036	2.694	2.84
Experimental	3.109a	.036	3.036	3.183

Covariates appearing in the model are evaluated at the following values: pre = 2.7447. Standard deviation and adjusted post-test mean of PFT shown in above table are different with the table no. 3 because here we eliminate the effect of covariant on the basis of initial difference in pre-test score.

Table no. – 3.2: ANCOVA table for post-test data in relation to PFT

Source	Type I Sum of Squares	df	Mean Square	F	P value
Corrected Model	6.193[a]	2	3.097	162.461	.000
Intercept	259.014	1	259.014	13588.662	.000
Pre	5.326	1	5.326	279.441	.000
Treatment Group	.867	1	.867	45.482	.000
Error	.515	27	.019		
Total	265.722	30			
Corrected Total	6.708	29			

r Squared = .923 (Adjusted r Squared = .918)

In above mentioned table we can see the F value for comparing the adjusted mean of two treatment group (Experimental and Control group) during post testing. Since p-value for treatment group is .000 which is less than 0.05, hence its significance. Since F statistic is significant Post hoc comparison

Table no. – 3.3: Post Hoc comparison for the group means in post measurement adjusted with initial difference pairwise comparisons

(I)group (J) group	Mean difference (I-J)	Std. Error	P value	95% Confidence Interval for Difference	
				Lower bound	Upper bound
Control experimental Control experimental	-.342 .342	.051 .051	.000 .000	-.0448 .0238	-.238 .446

Since the F-ratio in the above mentioned table (table no. 3.2) is significant, a pair wise comparison has been made in table no. 3.3. After reading the table no. 3.3 it may be noted here that p-value for mean difference between experimental and control group is .000. Hence p-value are less than the 0.05, it is significant at 0.5 level. Thus following conclusion can be drowning.

•There is significant difference between adjusted post-test mean of experimental group and control group in relation to PFT during post testing.

Graph – 1: Pair adjusted means and differences between means for the experimental groups and a control group for PFT

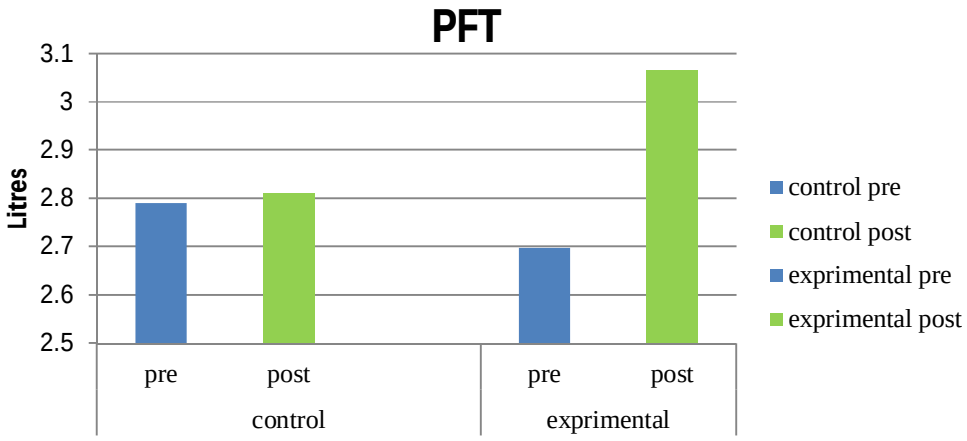


Table no. – 4: Descriptive statistics of different treatment group during post testing in relation to FEV1/FVC.

Groups	Mean	Std. Deviation	N
Control Group	85.4007	.81416	15
Experimental Group	86.1547	.90884	15
Total	85.7777	.93048	30

Table no. – 4.1: Descriptive statistics for the data measured in post testing after adjustment with the initial difference.

Groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control Group	85.477[a]	.198	85.070	85.883
Experimental Group	86.079[a]	.198	85.672	86.485

Covariates appearing in the model are evaluated at the following values: pre groups = 85.4607. Standard deviation and adjusted post-test mean of positive breath holding shown in above table are different with the table no. 4 because here we eliminate the effect of covariant on the basis of initial difference in pre-test score.

Table no. – 4.2: ANCOVA table for post-test data in relation to FEV1/FVC

Source	Type I Sum of Squares	Df	Mean Square	F	P value
Corrected Model	9.465[a]	2	4.733	8.169	.002
Intercept	220734.243	1	220734.243	381004.243	.000
Pre-groups	6.838	1	6.838	11.802	.002
Treatment group	2.628	1	2.628	4.536	.042
Error	15.642	27	.579		
Total	220759.351	30			
Corrected Total	25.108	29			

r Squared = .377 (Adjusted r Squared = .331)

In above mentioned table we can see the F value for comparing the adjusted mean of two treatment group (Experimental and Control group) during post testing. Since p-value for treatment group is .042 which is less than 0.05, hence its significance. Since F statistic is significant.

Table no. 4.3: Post hoc comparison has been made for adjusted mean of two group

(I) groups	(J) Groups	Mean Difference (I-J)	Std. Error	P value	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Control group	**Experimental group**	-.602*	.283	.042	-1.181	-.022
Experimental group	**Control group**	.602*	.283	.042	.022	1.181

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Since the F-ratio in the above mentioned table (table no. 4.2) is significant, a pair wise comparison has been made in table no 4.3. After reading the table no 4.3 it may be noted here that p-value for mean difference between experimental and control group is .042. Hence p-value is less than the 0.05. Thus there is significant difference between adjusted post-test mean of experimental group and control group in relation to FEV1/FVC during post testing.

Graph – 2: Pair adjusted means and differences between means for the experimental groups and a control group for FEV1/FVC

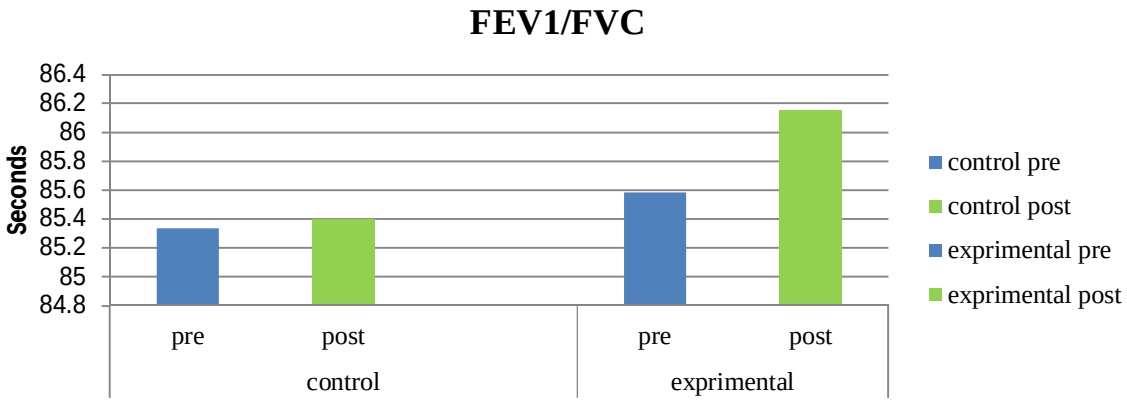


Table no. – 5: Descriptive Statistics of different treatment group during post testing in relation to PEFR

Group	Mean	Std. Deviation	N
Control	9.0847	.55490	15
Experimental	9.3540	.30877	15
Total	9.2193	.46199	30

Table no. - 5.1: Descriptive statistics for the data measured in post testing after adjustment with the initial difference.

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	9.059[a]	.108	8.838	9.281
Experimental	9.379[a]	.108	9.158	9.601

Table no. - 5.2: ANCOVA table for post-test data in relation to PEFR.

Source	Type I Sum of Squares	df	Mean Square	F	P value
Corrected Model	1.519[a]	2	.760	4.392	.022
Intercept	2549.883	1	2549.883	14741.363	.000
Pre	.765	1	.765	4.422	.045

Treatment group	.754	1	.754	4.361	.046
Error	4.670	27	.173		
Total	2556.073	30			
Corrected Total	6.190	29			

a. r Squared = .245 (Adjusted r Squared = .190)

In above mentioned table we can see the F value for comparing the adjusted mean of two treatment group (Experimental and Control group) during post testing. Since p-value for treatment group is .046 which is less than 0.05, hence its significance. Since F statistic is significant

Table no. – 5.3: Post hoc comparison has been made for adjusted mean of two group

(I) group	(J) group	Mean Difference (I-J)	Std. Error	P value	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Control	**Experimental**	-.320*	.153	.046	-.635	-.006
Experimental	**Control**	.320*	.153	.046	.006	.635

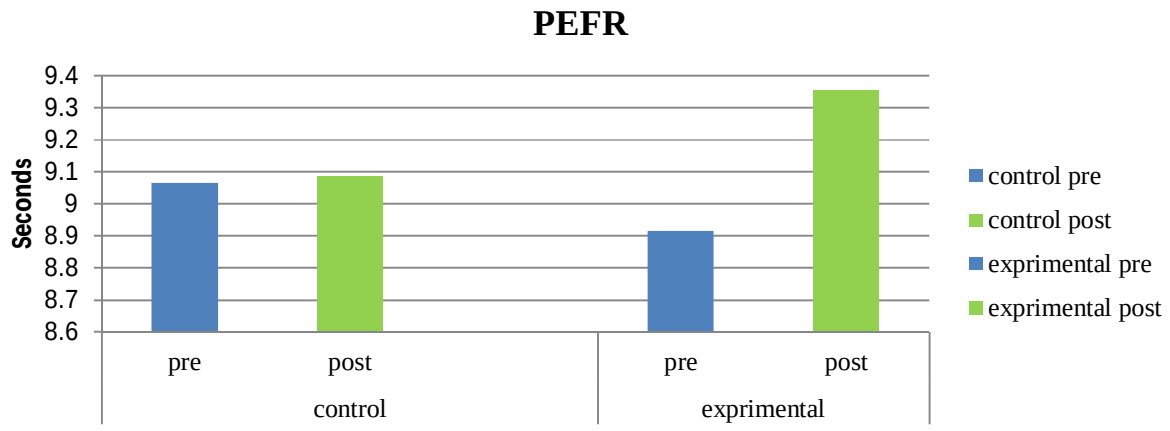
Based on estimated marginal means

*. The mean difference is significant at the .05 level. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Since the F-ratio in the above mentioned table (table no 5.2) is significant, a pair wise comparison has been made in table no 5.3. After reading the table no 5.3 it may be noted here that p-value for mean difference between experimental and control group is .046. Hence p-value are less than the 0.05, it is significant at 0.5 level. Thus following conclusion can be drown.

There is significant difference between adjusted post-test mean of experimental group and control group in relation to **PEFR** during post testing.

Graph – 3: Pair adjusted means and differences between means for the experimental groups and a control group for PEFR



Results of the Study

- The result of ANCOVA to find out the Effect of Bhastrika pranayama on PFT F-Ratio of 45.482 (p =.000) was found significant at .05 level of significance.
- The result of ANCOVA to find out the Effect of Bhastrika Pranayama on FEV1/VFC where F-Ratio of 4.536 (P=.042) was found significant at .05 level of significance
- The result of ANCOVA to find out the Effect of Bhastrika Pranayama on PERF where F-Ratio of 4.361 (P=.046) was found significant at .05 level of significance

Conclusions

Following the completion of the research, it can be concluded that eight weeks of Bhastrika pranayama treatment were effective in improving an individual's PFT (pulmonary function test), forced expiratory volume/forced vital capacity (FEV1/FVC), and peak expiratory flow rate (PEFR).

References

1. K. D. Ferreira, G. Aymeric, S. Damien, D. Ursula, R. Di. Franck,(2019), "Breathing with the mind: Effects of motor imagery on breath-hold performance", Physiology & BehaviorVolume 208, 1 September 2019.
2. Makwana K., Khirwadkar N., Gupta H. C., (1988), "EFFECT OF SHORT-TERM YOGA PRACTICE ON VENTILATORY FUNCTION TESTS", Volume 32 Number 3-july-eptember 1988 Ind. J. Physiol. Pharmac.
3. C. D. Evgenia, B. G. Petros, K. D. Maria, G. D. Nickos, (2013), "Effect of gender on maximal breath-hold time", European Journal of Applied Physiology, volume 113, pages1321–1330
4. Heath R. J., Irwin J. C., (1968), "An increase in breath-hold time appearing after breath-holding" Respiration PhysiologyVolume 4, Issue 1, January 1968, Pages 73-77
5. T. S. Magdalena, M. Rafal, R. Robert, Z. Aleksandra, (2019), "The effect of breath-hold diving on selected adaptive mechanisms in the circulatory-respiratory system in simulated static and dynamic apnoea", Baltic Journal of Health and Physical Activity 2019; 11(1): 7-17 Journal of Gdansk University of Physical Education and Sport.
6. L. J. Yoo, H. C. Lee, S. Y. Park, W. J. Kim, J. Lee, A. K. Kim, Y. H. Seol, M. C. Park,(2016), "The Short Breath-Hold Technique, Controlled Aliasing in Parallel Imaging Results in Higher Acceleration, Can Be the First Step to Overcoming a Degraded Hepatic Arterial Phase in Liver Magnetic Resonance Imaging; A Prospective Randomized Control Study", Investigative Radiology: July 2016 - Volume 51 - Issue 7 - p 440-446
7. H. V. Olivier, M. V. Alain, A. Vasileios, L. Dimitri, F. Veronique, D. Gael, B. Bruno,(2020), The use of cognitive mobile games to assess the interaction of cognitive function and breath-hold",Respiratory Physiology & NeurobiologyVolume 274, March 2020, 103359
8. F.R.John, B.E. Philip, John W. Severinghaus, (1995), "Hypoxic ventilatory response predicts the extent of maximal breath-holds in man", Respiration PhysiologyVolume 100, Issue 3, June 1995, Pages 213-222
9. M.Claudio, S.Alessandro, C. Danilo, P.Mirko, R. Andrea,L.Antonio, B. Remo,(2009), "Effects of depth and chest volume on cardiac function during breath-hold diving", European Journal of Applied Physiology, volume 106, pages683–689(2009)

10. Ferrigno M., Hickey D.D., Liner H.M., Lundgren E.C., (1986), "Cardiac performance in humans during breath holding", J od Applied Physiology Volume 60 Issue 6June 1986 Pages 1871-1877
11. Fickenworth, Luke; Fair, Jarrod; Le, Triet; and Hickey, Ashlynn (2020) "Effects of Different Aerobic Training Techniques on Vital Capacity and Breath Hold The Research Journal of Ohio Northern University: Vol. 1 :Iss. 1 , Article 6.
12. B. Manuel, S. Dzmitry, W. Hansjoerg, A. Anna, L. Frank, H. Jurgen, W. Frederik,(2010), "Breath-Hold Target Localization With Simultaneous Kilovoltage/Megavoltage Cone-Beam Computed Tomography and Fast Reconstruction",International Journal of Radiation Oncology*Biology*PhysicsVolume 78, Issue 4, 15 November 2010, Pages 1219-1226
13. M.C. Leanne, A.Lewis, F.J.S. Richard, C.R. Douglas,(2008), "A bilateral cortico-bulbar network associated with breath holding in humans, determined by functional magnetic resonance imaging",NeuroImageVolume 40, Issue 4, 1 May 2008, Pages 1824-1832
14. M.Elsa, K.Barry, C. Sophie, C. Orla, C.David, O. Terry,(2012), "The effect of reducing breath holding time to assess diffusion capacity",European Respiratory Journal 2012 40: P3220
15. Magro, E. (2012). Effect of Reduction of Breath-Holding Time In The Single-Breath Method To Assess Carbon Monoxide Diffusing Capacity.Masters dissertation. Technological University Dublin.
16. Godfery S., Campbell M. J. E., (1969), "MECHANICAL AND CHEMICAL CONTROL OF BREATH HOLDING", The Physiological Society, Volume54, Issue2April 7, 1969, Pages 117-128