International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979
Impact Factor: RJIF 5.72
Received: 02-03-2018; Accepted: 05-04-2018
www.allsubjectjournal.com
Volume 5; Issue 4; April 2018; Page No. 69-74

Effect of 6 weeks of therapeutic exercise on force vital capacity of person with COPD

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Abstract
Objective: The purpose of the study was to find out the effect of 6 weeks of Therapeutic exercise on force vital capacity of person with chronic obstructive pulmonary disease.
Methods: For the purpose of this study 30 male from Varanasi those who are suffering from COPD (chronic bronchitis) and under treatment process of same at S.S. hospital, IMS, B.H.U was selected purposively as the subject of the study. The age of subjects was ranged between 40 to 50 years. For the study pre test – post test randomized group design was used and involving 30 subjects who were grouped purposively into two groups (15 each). The first group 15 subjects were considered as control group and second 15 subjects were considered as experimental group. Force vital capacity was measured by pulmonary function test or Total lungs function test and scores was recorded in liters.
Statistical Technique: The data which was obtained from subject was analyzed statistically by the application of analysis of covariance (ANCOVA). The obtained "F" ratio was tested at. 05 level of significance.
Results & Conclusion: The results of the study showed that there is significant effect of 6 weeks of Therapeutic exercise on Force Vital Capacity. It is concluded that Therapeutic exercise have better effect for improvement of COPD patients in relation to force vital capacity.

Keywords: therapeutic exercise, force vital capacity & pulmonary function test

Introduction

Breathing is the source of our life energy. Inspiration has a much wider meaning than just taking in air: it also means being creative, in a very deep, complex sense. Expiration not only means exhaling air; it is relaxation, letting go, finally also letting go of life. This link between life, death, and breath has been considered by many religions and philosophical systems. We can survive without taking fluids for about 4 days, without solid food for about 4 weeks, but without breathing for only 2-3 minutes. Breathing also connects our inner body with the environment. Philosophically speaking it connects the individual with the universe. It also connects physical and psychological aspects and is related to all bodily systems. Therefore we need to ensure that our breathing and all related structures and functions work as well as possible.

Normally we inhale and exhale through the nose. The warm air of exhalation helps to dilate the blood vessels, improving blood supply. Air inhaled through the nose is moistened, warmed, cleaned, and examined through the sense of smell.

De Lateur defined therapeutic exercise as the prescription of bodily movement to correct impairment, improve musculoskeletal function, or maintain a state of well-being.1 It may vary from highly selected activities restricted to specific muscles or parts of the body, to general and vigorous activities that can return a convalescing patient to the peak of physical condition.

TherapeuticExerciseSeekstoAccomplishtheFollowinggoals

- Enable ambulation
- Release contracted muscles, tendons, and fascia
- Mobilize joints
- Improve circulation
- Improve respiratory capacity
- Improve coordination
- Reduce rigidity
- Improve balance
- Promote relaxation
- Improve muscle strength and, if possible, achieve and maintain maximal voluntary contractile force (MVC)
- Improve exercise performance and functional capacity (endurance)

The last 2 goals mirror an individual's overall physical fitness, a state characterized by good muscle strength combined with good endurance. No matter which types of exercise may be needed initially and are applied to remedy a patient's specific condition, the final goal of rehabilitation is to achieve, whenever possible, an optimal level of physical fitness by the end of the treatment regimen.

Methodology

For the purpose of this study 30 male selected from Varanasi those who are suffering from COPD (chronic bronchitis) and under treatment process of same at S.S. hospital, IMS, B.H.U was selected purposively as the subject of the study. The age of subjects was ranged between 40 to 50 years. For the study

pre test – post test randomized group design was used and involving 30 subjects who were grouped purposively into two groups (15 each). The first group 15 subjects were considered as control group and second 15 subjects were considered as experimental group.

Control Group	O1		O2
Pranayama Group	O3	T1	O4

O = Observation, T = Treatment

Force vital capacity was measured by pulmonary function test or Total lungs function test and scores was recorded in liters. The experiment group was taken 6 weeks Therapeutic exercise, in this training program only therapeutic exercise (Diaphragmatic Breathing, Segmental Breathing, Posterior Basal Expansion, Pursed-Lip Breathing, Positive Expiratory Pressure Breathing, Respiratory Resistance Training, Inspiratory Resistance Training, Incentive Respiratory Spirometry & Glossopharyngeal Breathing) performed by subjects with the help of experts. The data which was obtained from subject was analyzed statistically by the application of analysis of covariance (ANCOVA). The obtained "F" ratio was tested at. 05 level of significance.

Findings

Testing basic assumption to apply ANCOVA (Chan, Y. H., 2003)

Testing normality of data by Q-Q Plots

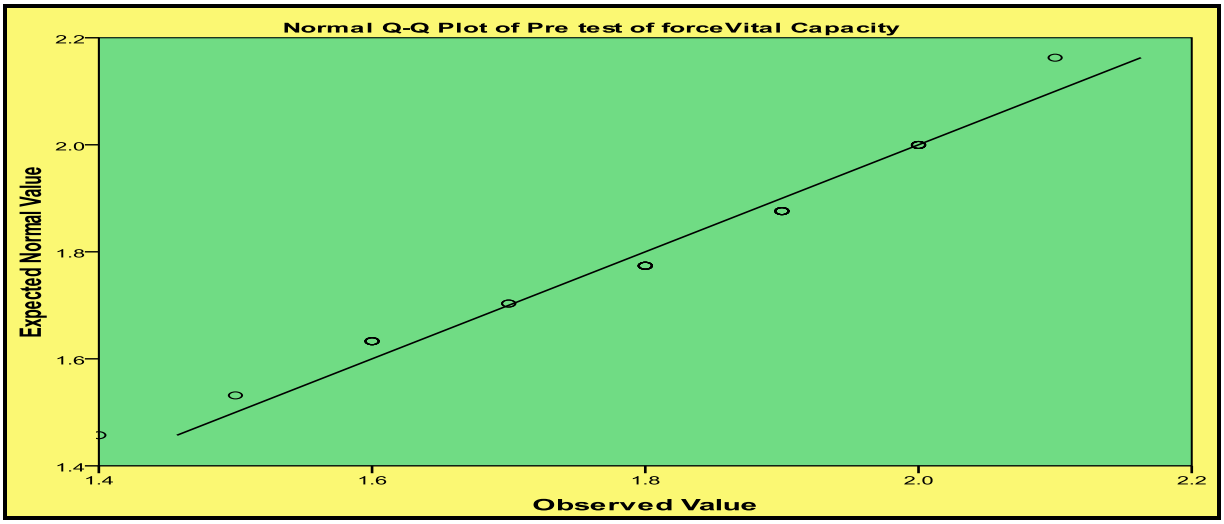

Fig 1: Testing Normality of data by Q-Q Plots

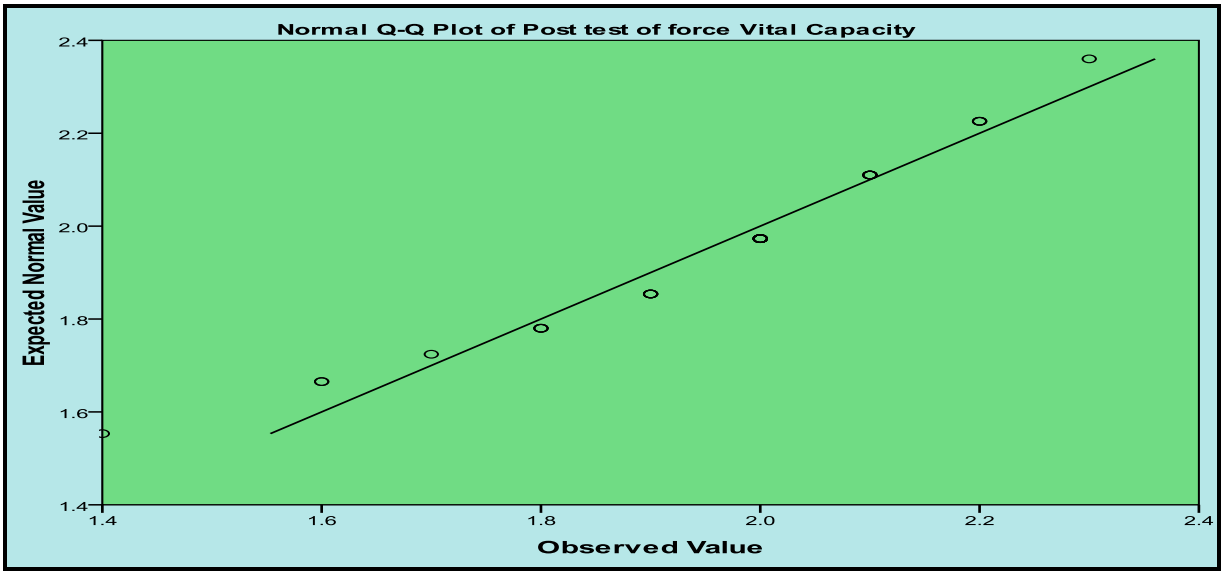

Fig 2

The Q-Q Plot compares the quantities of a data distribution with the quintiles of a standardized theoretical distribution from a specified family of distributions (in this case, the normal distribution). In the above Q-Q plots, the points are plotted along a line. The Q-Q. plots also verify that the distribution is normal.

Testing normality of data by normal curve with histogram

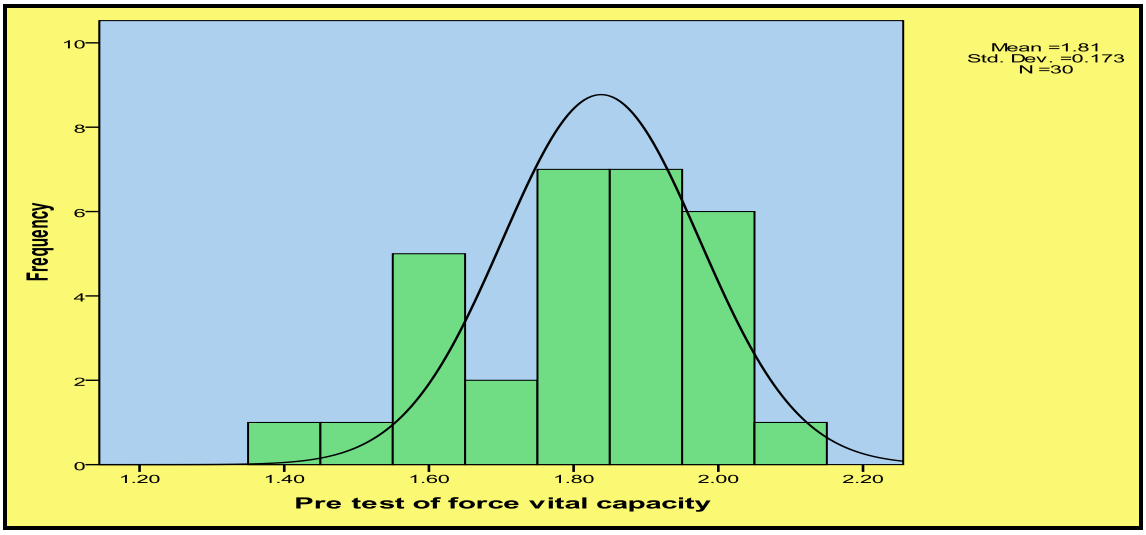

Fig 3

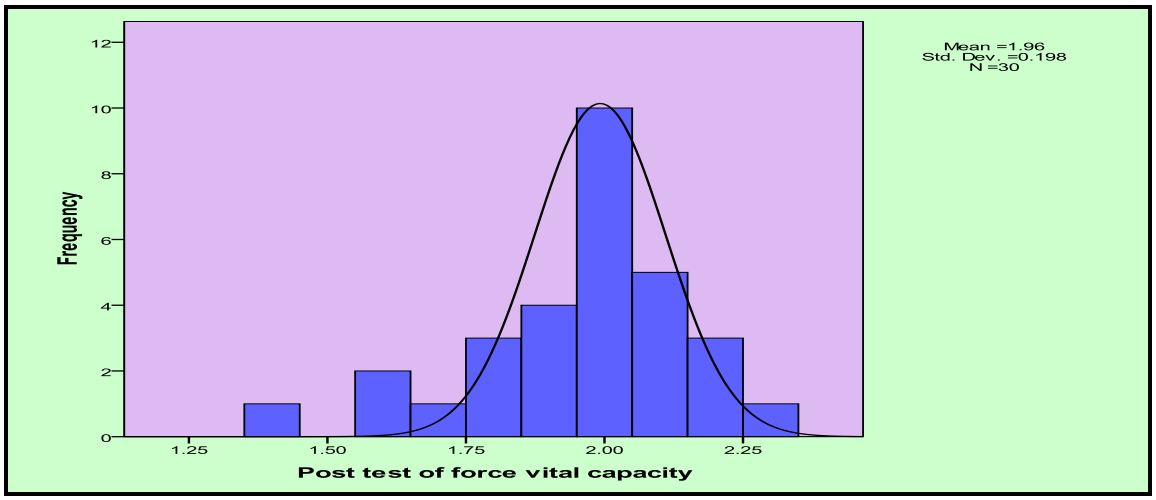

Fig 4

Histogram with normal curve belonging Pre and Post of force vital capacity satisfies the normal distribution of data.

Table 1: Testing normality of data by formal test

Levene's Test of Equality of Error Variances[a]			
Dependent Variable: Post test			
F	df1	df2	Sig.
1.620	1	28	.214

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Pre test + group

The formal test named levene's statistic test were also applied to conform normality of data. Force vital capacity scores, the variances were no significant different in the two group, levene's statistic value (1, 28) = 1.620, p<0.214, shows that the distribution is normal. It can be confident that population variances for each group are approximately equal and distribution is normal. Since data fulfils basic assumptions to apply analysis of covariance was applied to find out effect of 6 weeks of Therapeutic exercise on force vital capacity of person with chronic obstructive pulmonary disease

Table 2: Descriptive Statistics of Experimental and Control group in relation to Force Vital capacity

		N	Mean	Std. Dev	Std. Error	Minimum	Maximum
Pre test	Control	15	1.7867	.19591	.05058	1.40	2.10
	Experimental	15	1.8333	.14960	.03863	1.60	2.00
	Total	30	1.8100	.17291	.03157	1.40	2.10
Post test	Control	15	1.8667	.20587	.05315	1.40	2.10
	Experimental	15	2.0467	.14573	.03763	1.80	2.30

	Total	30	1.9567	.19772	.03610	1.40	2.30

Table 2 clearly indicates that the mean and standard deviations of force vital capacity at control and Therapeutic exercise group. The observed mean and standard deviation of pre test, force vital capacity of control group 1.78±0.19 & Therapeutic exercise group 1.83±0.14; and Post test, force vital capacity of control group 1.86±0.20 & Therapeutic exercise group 2.04±0.14 are respectively.

The data are further analyzed with the help of analysis of variance to find out the significance difference between means of pre-test and post test of Therapeutic exercise and control group in relation to force vital capacity. The results are presented in the table no 3.

Table 3: Analysis of Variance of Comparison of Means of Therapeutic exercise and Control Group in relation to Force Vital Capacity

		Sum of Squares	df	Mean Square	F	Sig.
Pre test	Between Groups	.016	1	.016	.538	.470
	Within Groups	.851	28	.030		
	Total	.867	29			
Post test	Between Groups	.243	1	.243	7.639	.010
	Within Groups	.891	28	.032		
	Total	1.134	29			

Table 3 revealed that, the pre test obtained 'F' value of. 538 is found to be no significant at. 05 level, which is clearly indicated that there are no significant difference and explains the random assignment of subjects to Therapeutic exercise and control group is quite successful. In relation to post test, significant difference is found among Therapeutic exercise and control group pertaining to force vital capacity, since obtained 'F' value of 7.639 is found significant at. 05 level.

Table 4: Adjusted post test means of therapeutic exercise and control group in relation to force vital capacity

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	1.888[a]	.021	1.845	1.931
Experimental	2.025[a]	.021	1.982	2.068

a. Covariates appearing in the model are evaluated at the following values: Pre test = 1.8100.

From the table 4, it is revealed that mean of control group is 1.888 with the standard error of 0.021 and mean of Therapeutic exercise is 2.025 with the standard error of 0.021. The data are analyzed and the results pertaining to analysis of co-variance of Therapeutic exercise and control group of COPD person in relation to force vital capacity for pre test-post test respectively and the results are presented in table 5.

Table 5: Analysis of covariance of comparison of adjusted post test means of therapeutic exercise and control group in relation to force vital capacity

	Sum of Squares	df	Mean Square	F	Sig.
Contrast	.139	1	.139	21.318	.000
Error	.175	27	.006		

Table 5 revealed that, the obtained 'F' value of 21.318 is found significant at. 05 levels. This result indicates that the treatment (Therapeutic exercise) is given to subjects has increase force vital capacity of subjects.

The Graphical representation of mean plot of Therapeutic exercise and control group in relation to force vital capacity is presented with the help of figure 6.

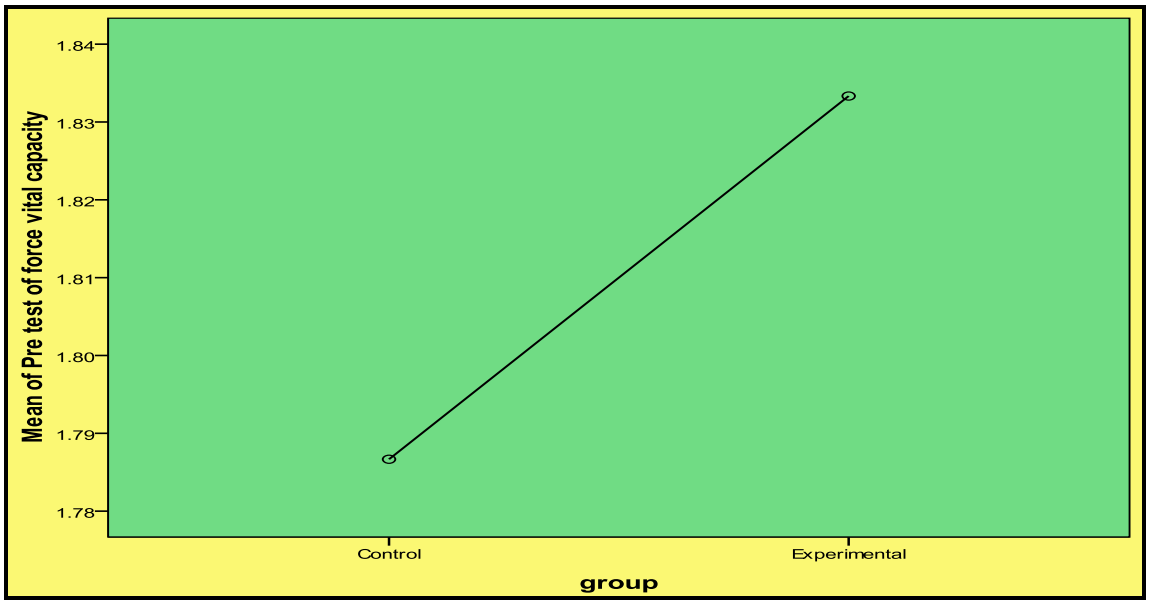

Fig 5

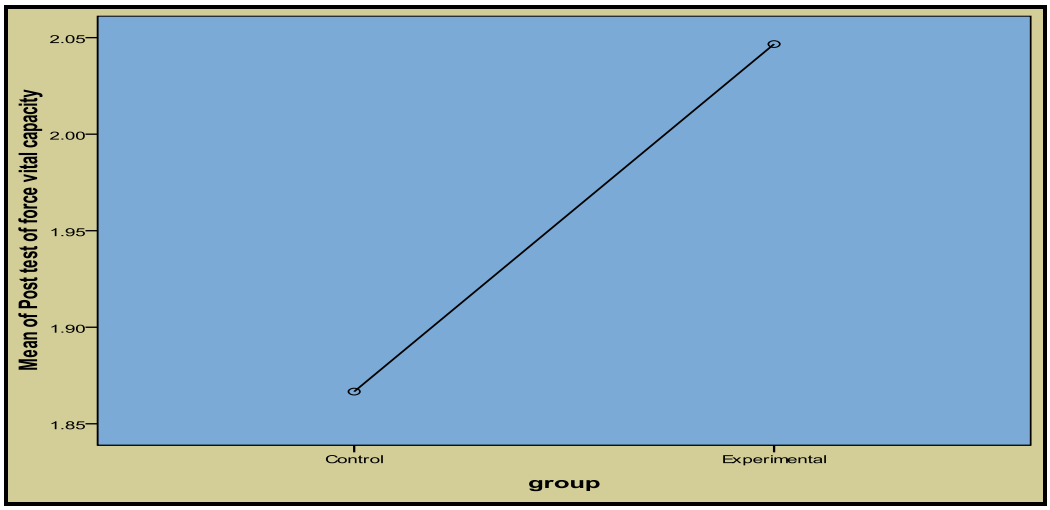

Fig 6: The Graphical representation of mean plot of Therapeutic exercise and control group in relation to force vital capacity

Discussion of Findings

Breathing is the source of our life energy. Inspiration has a much wider meaning than just taking in air; it also means being creative, in a very deep, complex sense. Expiration not only means exhaling air; it is relaxation, letting go, finally also letting go of life. This link between life, death, and breath has been considered by many religions and philosophical systems. In the Bible we read that God made man from the dust of the earth and breathed into his nostrils the breath of life, and man became a living being. In those ancient Indian texts that are particularly relevant to yoga, such as the Vedas, Upani ads, Yoga-Sūtras, and Ha ha-Yoga-Prad pikā, breathing is described as the essential process related to life. Our life starts with our first inhalation and ends with our last exhalation. We can survive without taking fluids for about 4 days, without solid food for about 4 weeks, but without breathing for only 2–3 minutes. Breathing also connects our inner body with the environment. Philosophically speaking it connects the individual with the universe. It also connects physical and psychological aspects and is related to all bodily systems. Therefore we need to ensure that our breathing and all related structures and functions work as well as possible.

In the present study, there is significant effect of therapeutic exercise program on Force Vital Capacity. In the present study, there was increase in FVC following practice of yogic exercise for 6 weeks. The improvement in pulmonary function can be attributed to practice of Pranayama like kapalabati, Anulom-Vilom, Ujjayi etc. These practices increase muscular strength and endurance of muscles in the thoracic cage, in turn improving the lung performance. Practice of yogic exercise helps in reducing the heart rate and blood pressure. It improves blood supply to organs, thereby increasing oxygenation, and removing the metabolic waste from the body. The reduced heart rate and blood pressure are due to the decreased sympathetic activity with a shift in the autonomic balance towards parasympathetic dominance. Decreased sympathetic tone causes vasodilation and increases the blood supply to various tissues in the body. Pranayama increases oxygen saturation, enhances the aerobic metabolism in the body. Due to increased blood flow, body is able to remove the metabolic waste more effectively. Practice of asanas enhances the efficiency of skeletal muscles. They perform better with effective utilization of the oxygen and nutrients. Thus the load on the heart and respiratory systems are reduced. These physiological adaptations improve the work performance of the COPD patients practicing yogic exercise. Therapeutic exercise also performance same aspect of physiological functions of COPD Patients and improve force vital capacity of subjects. The result of the study is in consonance with the findings of Vinay AV & Venkatesh D (2014), to assess the influence of short term practice of yoga for a month on Heart rate variability (HRV) and pulmonary function test. Twenty two healthy female volunteers in the age group of 30-60 years who practiced yoga for a month were included in the study. Heart rate variability was assessed by using HRV device (RMS Vagus, India) and pulmonary functions were assessed by computerized spirometry (Respmed Spirobank G, MIR SRL, Italy). Pre interventional assessment of HRV and spirometry was done in these subjects. Practice of yoga that included a set of physical postures (asanas), breathing techniques (Pranayama) and meditation (dhyana) done for duration of one month under the guidance of a certified yoga instructor. Post interventional assessment of HRV and spirometry was done. Statistical analysis was done to compare the changes using paired t test and Wilcoxan sign ranked test. There was a significant reduction in low frequency (LF) component of HRV from 31.25 (20.5-39.28) to 26.15 (17.57 - 29.30) and increase in Forced Vital Capacity (FVC), Forced expiratory volume in one second (FEV1) and Peak expiratory flow rate (PEFR) from 94.46 ± 13.55 to 96.31 ± 14.27, 93.46 ± 15.32 to 95.73 ± 16.48 and 79.96 ± 15.5 to 85.38 ± 18.45.($p<0.05$). Yoga on regular practice for a month improves Cardio-respiratory health in healthy females.

Conclusions

It is concluded that there is significant effect of therapeutic exercise on Force Vital Capacity of person with chronic obstructive pulmonary disease.

Practical Applications

The results of this study provide insight into therapeutic exercise program for improvement of force vital capacity of

COPD patients. However COPD patients are suffering from breathing problem in during period of disease. This research paper provides better knowledge for improvement of COPD patients through therapeutic exercise program.

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