Effect of Deep Breathing Exercises on Vital Capacity in Female Physiotherapy Students.

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ABSTRACT

Background- In recent times reduced amount of physical fitness & exercises levels among students have resulted them in adapting sedentary lifestyle thereby reducing their vital capacity. Initially the complications arising from low level of vital capacity may be asymptomatic but if not treated in near future can cause fatal complications.

Aims & Objectives- To study the effect of deep breathing exercises on vital capacities in female physiotherapy students.

Materials & Methods- Depending upon the inclusion criteria (vital capacity less than 2 liters) & exclusion criteria (no pathological involvement of lungs, 102 female physiotherapy students were selected for a study duration of 8 weeks. Deep breathing exercises were given to them on day 1 with 10 repetitions. Follow up was kept every 2 weeks & 5 repetitions were added every week to serve the incremental purpose. Deep breathing was asked to perform twice daily (in the morning & at night). Wilcoxon signed ranked test was used for statistical analysis.

Result- vital capacity had improved from 2.6 liters to 3.4 liters.

Conclusion- Deep breathing exercises are effective in improving vital capacity in female physiotherapy students.

Keywords- Vital Capacity, Sedentary Lifestyle, Deep Breathing Exercises.

INTRODUCTION

In the last decade’s lung function parameters have often been used as health indicators in epidemiological and clinical research [¹] & were used in assessing respiratory status. [²]Vital Capacity (as it was first ever described by Hutchinson, a London surgeon in 1846 as amount of air expired from fullest inspiration to the fullest expiration. [³] Normal vital capacity is around 4800ml. [⁴] The measurement of vital capacity is therefore a frequently used method in modern anthropological investigation and serves as a good indicator of assessing the living condition, abilities, physical and health condition of individual and populations. [⁵]
Vital capacity is evaluated using an Incentive Spirometer. Here the subject breathes out (or in) maximally through a tube attached to the incentive Spirometer device with sealed lips held at the mouthpiece & nose clips attached. At least 3–5 ‘satisfactory’ efforts need to be recorded. Physical inactivity is now a global non-communicable disease, which causes lung functions to decline over a period of time. Physical Inactivity has direct co-relation with reduced vital capacity. Hence, Vital capacity in today’s generation becomes strong indicator of lung function. Individuals with active lifestyle show up to 50ml improvement in their VC, whereas the subjects with sedentary lifestyle shows 30ml reduction in their VC.

Generally we observe that Students encounter all kinds of stressors, such as excelling in academics, vague future and problems associated with adaptation into the college environment, social adjustments, emotional outbursts, varying physical demands, family problems. These stressors has a major role in reduction of vital capacity as the onset of stress in any individual is demonstrated with a change in the pattern of breathing. Similarly, when students are exposed to various stressors, changes in the breathing pattern takes place. Shallow breathing caused reduction in the excursion of diaphragm along with increased respiratory rate. This phenomenon if not corrected now, will give rise to systemic complications & will reduce the overall capacity of lungs.

Breathing exercises enhances the body’s ability to absorb & make use of oxygen optimally, by guarding the body against onset of illness. This excursion helps in activation of the diaphragm. Although the diaphragm is used 24/7 but it goes largely unnoticed in individuals with sedentary lifestyle. During deep breathing the diaphragm contracts, in conjunction with the intercostals muscles strongly, lowering the pressure in the thoracic cavity. This enables air to enter the lungs and fill the entire capacity of lung, utilizing the entire volume of lung available for that individual. Regular practice of deep breathing exercises helps to increase parasympathetic tone, decreases sympathetic activity, improves cardiovascular and respiratory functions, decreases the effect of stress and strain on the body and improves physical and mental health.

Need of the study is that In recent times reduced amount of fitness and exercises levels among students have resulted in an increased competitive and stress levels. Due to which they have difficulty in incorporate active & healthy lifestyle reducing their vital capacity. Affected vital capacity at such an early age may be asymptomatic at present but will give rise to complications and co-morbid factors affecting the lung function of the students like breathlessness, difficulty in concentration, low mood, emotional liability, reduces academic performance in near future. There can be various causative factors for reduced vital capacity like easy means of travelling, lift facilities, high penetration of television & internet, intake of junk & fast food. As very few studies have been performed on the measurement of vital capacity & there is limited literature present on the effect of deep breathing exercises on vital capacity in female students, so this study is a need of the hour. Hence the objective of this study was to find out the effect of deep breathing exercises on vital capacity in female physiotherapy students.

### MATERIALS AND METHODS
It was a Experimental Study that took place at Dr. D Y Patil College of Physiotherapy, Pimpri, Pune on 102 female physiotherapy students in 2016-2017 of age group 18 to 25. Random sampling was performed. Inclusion criteria were females of age group 18 to 25, females with vital capacity less than 2 liters, females who are willing to take part in the study. exclusion criteria was pathological conditions that reduce vital capacity, females indulged in other exercises or yoga sessions of at least 30 minutes/day for 3 days/week since 6 months, females who are on anti depression drug therapy & females unwilling to participate in the study.
PROCEDURE
Female students were selected randomly depending on the inclusion and exclusion criteria. Ethical clearance was taken from the ethical committee. Information was given to the subjects regarding the project and procedure was explained to them. Written informed consent was taken from the subjects willing to participate in the study. Incentive Spirometry was performed to assess the vital capacity in subjects in liters. Initially 105 subjects were included in the study but 3 subjects did not maintain follow up due to cold for 15 days so they were excluded from the study and from the analysis.

PROCEDURE FOR INCENTIVE SPIROMETRY \textsuperscript{(19)}

The procedure was first performed by the therapist in front of the subjects. Sitting on the edge of the bed with back and upper limb supported, by holding the incentive spirometry in an upright position. After one complete cycle of inspiration and expiration, placing the mouth piece in the mouth and seal the lips tightly around it. Breathing into the mouthpiece that will be connected to a spirometry.

Breathing was as slowly and as deep as possible while noticing the ball/piston rising towards the top of the column. The ball/piston indicator should reach the maximum as per effort. Holding the breath as long as possible. Then by exhaling slowly and allow the ball/piston to fall to the bottom of the column.

Rest pause was given after each reading for 10-13 seconds and the procedure was repeated thrice. One best reading was selected from the three readings.

PROCEDURE OF DEEP DIAPHRAGMATIC BREATHING \textsuperscript{(19)}

The subject were in crook lying position where gravity assists the diaphragm (semi- fowler’s position). By keeping the shoulder relaxed and upper chest quiet, allowing the abdomen to rise slightly.

Hold for a count of 6 and then the subject were asked to relax and exhale slowly through the mouth.

FREQUENCY: Practice deep diaphragmatic breathing twice daily (in the morning and just before bed at night 15 times)

Results –

Table 1: Vital Capacity in female subjects using Spirometer.

<table>
<thead>
<tr>
<th>READINGS</th>
<th>MEAN (litres)</th>
<th>SD</th>
<th>P VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE</td>
<td>2.647</td>
<td>0.448</td>
<td>*&lt;0.001</td>
</tr>
<tr>
<td>POST</td>
<td>3.424</td>
<td>0.331</td>
<td></td>
</tr>
</tbody>
</table>

The Wilcoxon signed-rank test was used for analysis of the values, as the dependent t-test was inappropriate. This test is used to compare two sets of scores that come from the same participants. The values were statistically improved from 2.64 to 3.42 liters. The level of significance- *p <0.001

The values of vital capacity were statistically improved from 2.64 to 3.42 litres. The level of significance *p <0.001

Statistical Method

Descriptive & Inferential statistical analysis has been carried out in the present study. Results on continuous measurements are present on mean standard deviation (SD) (MIN-MAX) & result on categorical measurements is presented in number (%). Significance is assessed at 95% level of significance.

Wilcoxon Signed-Rank Test: It is a nonparametric test equivalent to the dependent t-test. As the Wilcoxon signed-rank test does not assume normality in the data, it can be used when this assumption has been violated & the use of the dependent t-test is inappropriate. It is used to compare two sets of scores that come from the same participants. This can occur when we wish to investigate any change in scores from one time point to another, or when individuals are subjected to more than one condition.
DISCUSSION
The study was conducted in 102 females in a span of 8 weeks with an objective to find the effect of deep breathing exercises on vital capacity & other lung functions, in female physiotherapy students of age group 18 to 25 with Mean age of 19.89 & SD 2.19. 
The Vital Capacity was found out with the help of Incentive Spirometer. 
The study reported that Deep breathing exercises were found to be effective in improving the vital capacity of female subjects from 2.64 to 3.42 liters (p <0.001) the reason for the improvement of vital capacity could be that Deep breathing exercises enhances movement of the ribs in an effective manner allowing the passage of air in & out of the lungs. While inhalation the diaphragm lowers down to accommodate air in the lungs. This excursion helps in activation of the diaphragm. Although the diaphragm is used 24/7 but it goes largely unnoticed in individuals with sedentary lifestyle. During deep breathing the diaphragm contracts, in conjunction with the intercostals muscles strongly, lowering the pressure in the thoracic cavity. This enables air to enter the lungs and fill the entire capacity of lung, utilizing the entire volume of lung available for that individual mainly to the basal segments of the lungs. Hence these exercises can improve the distribution of air to the basal segments of lungs. During deep breathing, there is increased requirement of oxygen in the working respiratory muscles. This increased requirement of oxygen stimulates the chemo-sensitive area located bilaterally in the medulla. This in turn stimulate the dorsal group of nucleus Tractus Solitarus which sends strong signals to inspiratory group of muscles which cause forceful inspiration and expiration thereby improving the vital capacity. 
Also study done by Rumpis Agus Sudarko et al concluded that breathing exercises conducted for 8 weeks can improve lung vital capacity of 0.181 liter This increase occurred because of the stressor were a regular breathing, guided, programmed & measured & thud have a positive contribution to the change.

CONCLUSION
Deep breathing exercises are effective in improving Vital capacity in female physiotherapy students.

Abbreviations- vital capacity- VC, deep breathing exercises- DBE

Figures-

Figure No. 1-Semi- Fowler’s Position

Figure No.2 Abdominal Breathing

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