Effectiveness of breathing exercise on lung volume among sculptors in selected community setting, Kanchipuram district, Tamil Nadu, India

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Abstract

Background: The study was aimed at assessing the Effectiveness of breathing exercise on lung volume among sculptors of a selected community in Kanchipuram district, Tamil Nadu, India. Objectives: The objectives of the study were to assess the level of lung volume, effectiveness of breathing exercise among sculptors with low lung volume and associate the level of lung volume with selected demographic variables of the sculptors with low lung volume. Materials and Methods: Purposive sampling was used to select 80 sculptors with low lung volumes. The tool for data collection has validated and reliability was established. The demographic data was collected using interview technique and lung volume was assessed by spirometer. The collected data was tabulated and analyzed using descriptive and inferential statistical methods. Results: The study showed that 64 (80%) of sculptor’s lung volumes improved after breathing exercise whereas 16(20%) of sculptor’s lung volume did not improve after breathing exercise. Conclusion: This study concluded that the lung volume among sculptors was low due to silica dust exposure breathing exercise improved the lung volume among sculptors and the assessment of lung volume was important among sculptors in determination low lung volume for early prompt treatment.
Introduction

Human Lungs are a pair of spongy and air-filled organs located on either side of the chest. The trachea conducts inhaled air into the lung through its tubular branches called as bronchi. The bronchi divides into smaller branches called bronchioles and finally becomes microscopic alveoli.\(^1\)

Lung volumes also known as respiratory volumes. It refers to the volume of gas in the lungs at a given time duration of the respiratory cycle.\(^2\)

Respiratory problems associated with sculptors are Asthma, Rhinitis, Bronchitis, obstructive disorders, and reduced vital capacity. Respiratory disorders occur due to the fumes and dust from sanding and grinding.\(^3\)

Breathing exercises are beneficial in increasing the lung volume. Numbered breathing requires that an individual breathe in and out to an increasing pattern of counts. To perform this exercise the individual needs to stand still and take a deep breath with the eyes closed and force all the air out of the lungs when count no 1 calmly, while inhaling hold breathe for few seconds slowly exhale counting 2 and 3 calmly repeat 5 times.\(^{11}\)

In India, there is lack of resources and awareness of stone crushing areas and the preventable measures against inhalation of dust particle are generally low. Workers who are exposed to silica dust over a long time can develop a considerable lung function impairment that cannot be reversed. Deposition of silica dust in the lung is one of the key events involved in occupational related lung diseases. Many factors such as dust type, exposure duration, concentration and the size of the dust particles in the breathing zone influence silica deposition in airways.\(^{6}\) For instance, the crystalline form of silica, particularly quartz and cristobalite is associated with an increased risk for various silica-related lung diseases compared to amorphous type. Furthermore dust particles within the size range of 0.5 to 3 microns are retained in the lungs and continue to exert their effect even after cessation of exposure of dust.\(^{6}\)

Need for the study

Haeranah Ahmad., Ririn Arminish Wulandari. (2016) conducted a study on environmental factor and lung function impairment among household industrial workers of stone carving crafts. The result showed that the stone carvers’ lung function was decreased among 62% of respondents, 90% of those individuals had a restrictive type of pulmonary disease.\(^7\)
The Worldwide Health burden (word lung day 2019) 65 million people suffer from chronic obstructive pulmonary disease and 3 million die from each year, 334 million people suffer from asthma, 10 million develop tuberculosis.[10]

According to the American Lung Association more than 35 million people's are have a preventable chronic lung disease. Of all the lung diseases in United States, asthma is the most common (25 million), followed by interstitial lung disease (12million) and chronic obstructive pulmonary disease (11million). The rate of mortality from obstructive lung disease in women doubles from 1980 to 1994, corresponding to an increase in smoking.[9]

**Objectives of the study**

- To assess the level of lung volume among sculptors.
- To assess the effectiveness of breathing exercise among sculptors with low lung volume.
- To associate the level of lung volume with selected demographic variables among sculptors with low lung volume.

**Hypothesis**

\( H_01 \): There is no significant difference between pre and posttest lung volume among sculptors.

\( H_02 \): There is no significant association between pre and posttest of lung volume among sculptors with their selected demographic variables.

**Material and Methods**

**Research approach and design:** A Quantitative research approach with a Community based Pre Experimental one group pre-test and post-test design was found suitable for the study and

**Research setting:** The study was conducted and population of the study was sculptors in a selected community setting, Kanchipuram district, Tamil Nadu, India.

**Population:** Population included all the sculptors in a selected community, Kanchipuram district, Tamil Nadu, India.

**Sample:** Sculptors who fulfill the inclusion criteria.

**Inclusion criteria:**

- Male who are sculptors.
Persons aged above 20 years to 49 in a selected community setting.

Persons who can understand and speak in Tamil or English

Exclusion Criteria:

Persons who are known case of any respiratory problems.

Persons who are taking medication for current respiratory problem.

Persons who are not willing to participate.

Sample size estimation

\[ S = Z^2P(1-P)/(m^2) \]

S=Sample size, Z=Z scores , P=Population proportion , M=Margin error.

Confidence level-95 percentage, Confidence interval- 0.5, population-100.

\[ = (1.96)^2*0.5*(1-0.5)/(0.05)^2 \]

=384.16

\[ S=\frac{S}{1+(S-1)/POPULATION} \]

= 384.16/(384.16 – 1)/100

= 80

Sample size was estimated to be 80 in number residing in the selected community setting

Significant level at 0.05

Sampling technique

Purposive sampling technique.

Research tool

Section A
Demographic variables included Age, Body mass index, Duration of sculpting, History of smoking, and Co-morbidities.

Section B

Lung Volume

Lung volume was assessed by Spirometer. Normal range: 3.5 to 4.5 liters/minutes

Procedure for data collection

The investigator selected the subjects who fulfilled the inclusion criteria.

↓

Brief explanation was given about the purpose of study.

↓

Written consent was taken and Assurance was given that the data collected from the participants will be utilized only for the purpose of study and the demographic data was collected using interview technique

↓

Spirometer was used to assess the lung volume of the sculptors (Pretest)

↓

If the lung volume was less than 3.5 to 4.5 liters/minutes breathing exercises Deep breathing exercise, Pursed lip breathing, Alternate Nostril breathing and Diaphragmatic breathing which helps in the expansion of lung tissue surface. Breathing exercises will be teach to the participants for 30 minutes once a day for 30 days

↓

After 30 days, lung volume of the sculptors was reassessed with lung volume of the sculptors (posttest)

Ethical considerations

Formal written consent was obtained from the study sample before collecting the information, anonymity and confidentiality was maintained during the study.
Data analysis

The collected data was analyzed and interpreted using descriptive and inferential statistics. Descriptive analysis was used to analysis the demographic data. Paired ‘t’ test was used to evaluate the effectiveness of breathing exercise in the Post-test. Pearson chi square test analysis was used to associate with the selected demographic variables with the effectiveness of breathing exercise on lung volume among sculptors.

Results and Discussion:

SECTION A: Distribution of demographic characteristics.

TABLE 1: Frequency and percentage distribution of demographic characteristics like age and body mass index. N = 80

<table>
<thead>
<tr>
<th>S.no</th>
<th>Characteristic</th>
<th>Category</th>
<th>Lung volume among the sculptors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>frequency</td>
</tr>
<tr>
<td>1.</td>
<td>Age</td>
<td>20 - 29 years</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 - 39 years</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 - 49 years</td>
<td>37</td>
</tr>
<tr>
<td>2.</td>
<td>BMI</td>
<td>Underweight</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Normal</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Overweight</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Obese</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe obese</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Morbid obese</td>
<td>0</td>
</tr>
</tbody>
</table>

Frequency and percentage distribution of demographic characteristics like age and body mass index it showed that maximum age group were in the age group of 40-49 years (46%); Majority of the patients were obese (42.5%). [Table 1]
Figure: 1 Percentage distribution of the demographic characteristic among the sculptors according to working experience

Percentage distribution of the demographic characteristic among the sculptors according to working experience showed that majority of the sculptors (64%) had an experience of more than 3 years, 14% sculptors had 1-2 years of experience, 12% had 2-3 years of working experience and 10% were below one year. [Figure 1]

Figure: 2 Percentage distribution of the demographic characteristic among the sculptors according to smoking habit

Percentage distribution of the demographic characteristic among the sculptors according to smoking habit showed that 51% of sculptors had a smoking habit, while 49% were non-smokers. [Figure 2]
Percentage distribution of the demographic characteristic among the sculptors according to smoking habit showed that 49% of them were smokers and 51% of them were non-smokers.[Figure 2]

Figure 3: The figure shows that the demographic characteristics among the sculptors according to the co morbidity

<table>
<thead>
<tr>
<th>Co morbidity of sculptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetic Mellitus</td>
</tr>
<tr>
<td>Hypertension</td>
</tr>
<tr>
<td>Cardio Vascular Disease</td>
</tr>
<tr>
<td>Obesity</td>
</tr>
<tr>
<td>Nil</td>
</tr>
</tbody>
</table>

Percentage of the lung volume among the sculptors according to the co morbidity showed that 32% of them had no co morbidities whereas 24% had diabetes mellitus, 24% were obese, 11% were hypertensive and 9% had cardiovascular disease.[Figure 3]

SECTION B:Distribution of the effectiveness of breathing exercise on lung volume among the sculptors.

TABLE 2: Frequency, percentage, mean, standard deviation of effectiveness of breathing exercise lung volume among the sculptors N=80

<table>
<thead>
<tr>
<th>Experimental</th>
<th>frequency</th>
<th>Percentage</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre test</td>
<td>80</td>
<td>100 %</td>
<td>2.73</td>
<td>0.426</td>
</tr>
<tr>
<td>Post test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>improved</td>
<td>64</td>
<td>80 %</td>
<td>3.40</td>
<td>0.338</td>
</tr>
<tr>
<td>Not improved</td>
<td>16</td>
<td>20 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Frequency, percentage, mean, standard deviation of effectiveness of breathing exercise lung volume among the sculptors showed that of the 80 sculptors with low lung volume 80% of them showed an improvement in their
lung volume whereas 20% did not show any improvement. Witha paired t test value of 25 and Mean value of pre test is 2.73 and posttest is 3.40[Table 2]

SECTION C: Association between lung volume and selected demographic variables.

TABLE 3: Association between lung volume and demographic variables of the sculptors N=80

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Category</th>
<th>No. of sample</th>
<th>Lung volume of post test</th>
<th>$\chi^2$</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Improved</td>
<td>Not improved</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>20-29 years</td>
<td>19</td>
<td>18</td>
<td>1</td>
<td>6.994</td>
</tr>
<tr>
<td></td>
<td>30-39 years</td>
<td>24</td>
<td>21</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40-49 years</td>
<td>37</td>
<td>25</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>Low weight</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>3.903</td>
</tr>
<tr>
<td></td>
<td>Normal weight</td>
<td>18</td>
<td>15</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased weight</td>
<td>33</td>
<td>28</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Obesity</td>
<td>22</td>
<td>15</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe obesity</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Morbid obesity</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Working experience</td>
<td>Below 1 year</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>2.718</td>
</tr>
<tr>
<td></td>
<td>1-2 year</td>
<td>11</td>
<td>10</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2-3 year</td>
<td>10</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 years above</td>
<td>52</td>
<td>38</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>Yes</td>
<td>43</td>
<td>34</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

http://doi.org/10.36295/ASRO.2020.232398
The association of lung volume among the sculptors with demographic variables showed that there is no significant association between effectiveness of breathing exercise on lung volume among the sculptors with selected demographic variables like, BMI($\chi^2=3.903$), working experience($\chi^2=2.718$), smoking habit($\chi^2=0.048$). There is significant association between lung volume among the sculptors with selected demographic variables like age($\chi^2=6.994$), co morbidity ($\chi^2=95.7$).[Table 3]

**Major findings of the study discussed under the objectives**

1. **To assess the level of lung volume among sculptors.**

80 sculptors was found with the low lung volume

2. **To assess the effectiveness of breathing exercise among sculptors with low lung volume.**

   - 64 (80%) of sculptors lung volume improved after the breathing exercises.
   - 16(20%) of sculptors lung volume was not improved after the breathing exercises.

3. **To associate the level of lung volume and selected demographic variables among sculptors with low lung volume.**

   There was no significant association between effectiveness of breathing exercise lung volume among the sculptors with selected demographic variables like, BMI($\chi^2=3.903$), working experience($\chi^2=2.718$), smoking
habit($\chi^2=0.048$). A significant association was found between lung volume among the sculptors with selected demographic variables like age($\chi^2=6.994$), co morbidity ($\chi^2=95.7$).

**Conclusion**

This study concluded that the lung volume among sculptors was low due to silica dust exposure. Breathing exercises helped improve the lung volume among sculptors.

**Acknowledgement:** The authors are grateful to all the sculptors who participated in the study.

**Declarations:**

Ethical approval: Ethical Approval was obtained from Institutional Human Ethics Committee.

Conflicts of interest: Nil

Source of funding: self

**References**


http://erswhitebook.org/chapters/theburdenoflungdisease

