COMPARATIVE ANALYSIS OF LUNG AGING PROCESS IN OBESE AND NON-OBESE ADULTS IN A TERTIARY CARE HOSPITAL

Dr. Muthukumaran L1*, Dr. Gangai Amaran2, Ms. Kowshalya.B3, Dr. N. Meenakshi4, Dr. Aruna Shanmuganathan5, Mrs. Jenny.J6, Dr. Mithun Joy Karnot7

Associate professor1, BSC Respiratory Therapist3, Professor & Head4, Professor5, Assistant Professor2&6, Senior Resident7

Department of Respiratory Medicine, Chettinad Hospital & Research Institute (CHRI), Chettinad Academy of Research and Education (CARE), Kelambakkam, Tamil Nadu, India.

Corresponding Author*:

Dr. Muthukumaran L.,

Associate Professor,

Department of Respiratory Medicine,

Chettinad Hospital & Research Institute (CHRI),

Chettinad Academy of Research and Education (CARE),

Kelambakkam, Tamil Nadu, India 603103

E Mail ID: mkumaran72@gmail.com

ABSTRACT:

Introduction: Obesity has a mass loading effect of adiposity on the thoracic cage and abdomen can have an effect on respiratory mechanics leading to decreased chest wall and lung compliance, decreased pulmonary gas exchange, limitations in exercise capacity and altered pulmonary physiology. The aim of the study is compare the influence of obesity in lung aging process in a tertiary care hospital in South India. Methods: A hospital based prospective comparative study was conducted in Department of Respiratory Medicine, Chettinad Hospital & Research Institute for which about 150 students were recruited. Results: The study revealed that lung age increases 15.85 % with statistical significance (p=0.001) eventually compared with the chronological age. But in the non-obese group there were no significant changes. Conclusion: In present study it has been concluded that obesity with increasing BMI have direct effect on lung aging process along with reducing lung volumes leading to airway/restrictive lung disease in their future.

Keywords: Obesity, BMI, Lung aging


INTRODUCTION: Obesity is defined as an excessive accumulation of fat that may have an extent which leads to the higher risk of health \(^{(1)}\). The alarming worldwide increase in overweight and obesity has reached epidemic proportions in recent years becoming a public health and economic problem, and its prevention has been one of the priorities of the World Health Organization (WHO)\(^{(2)}\). Obesity is diagnosed when the body fat percentage is high in relation to the lean body mass or the BMI \(\geq 30\text{kg/m}^2\) which is associated with the increased morbidity and mortality. The mass loading effect of adiposity on the thoracic cage and abdomen can have an effect on respiratory mechanics leading to decreased chest wall and lung compliance, decreased pulmonary gas exchange, limitations in exercise capacity and altered pulmonary physiology\(^{(3)}\). The concept of lung age relates to a person’s current lung function in which his/her lung function is considered abnormal when compared to their chronological age. It has also been used in order to motivate the smoking cessation and to understand the clear pulmonary function results for the patients and the general public who can readily understand the spirometric changes which is becoming a new tool for the early identification of functional abnormalities in lung disease\(^{(2)}\). Obesity has a clear potential to have a direct effect on respiratory wellbeing, since it increases oxygen consumption and carbon dioxide production, it also stiffens the respiratory system and increases the mechanical work needed for breathing\(^{(4)}\). It is also recognized as an important risk factor for developing respiratory diseases, such as hypoventilation syndrome and sleep apnea, as well as for the reduction in lung volumes. Obesity around the abdomen further leads to worsening lung function and respiratory symptoms. Lower body fat deposition is less associated with respiratory symptoms in comparison. Fat tissue accumulation impairs ventilatory function in adults and children. This study is focused compare the influence of obesity in lung aging process in a tertiary care hospital in South India.

MATERIALS AND METHODOLOGY: Apparently 150 healthy young adult volunteers with the age group of 18 to 60 years was enrolled for this study according to their BMI. The first group consisted of Non-Obese individuals with BMI of 18.5 to 29.9 kg/m and the second group consisted of Obese individuals with BMI of more than 30 kg/m. Written consent form were collected from the patient after explaining the protocol. Individuals with pre-existing lung disease, hemodynamic instability, unable to perform spirometry, active infections, no thoracic/abdomen surgeries in the past 3 months and individuals under 20 years of age, as determined by the original formula for calculating lung age was excluded from the study. All the subjects underwent chest X-ray and Electrocardiography to confirm the above mentioned exclusion criteria. All the individuals underwent through evaluation of medical history and a detailed physical examination by the pulmonologists\(^{(2)}\). All the parameters and clinical details were recorded in a well prepared Performa. The enrolled individuals were requested to perform the test in a empty stomach. And also requested to avoid the intake of beverages and tea, coffee before undergoing the test. All subjects underwent the spirometry tests, in sitting position, using techniques recommended by the American Thoracic Society (ATS). The subjects were asked to take the maximum deep inspiration and then blow out with maximum effort into the mouthpiece by wearing a nose clip for six seconds and then advised to take a forcible deep inspiration through the mouthpiece. The patients were advised not to inspire inside or stop expiring during the test. The patients were asked to do maximum three trials. The validity of the test was verified according to the ATS recommendations. The parameters that were measured by spirometry are: the forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1) and the ratio of FEV1 to FVC (FEV1/FVC, expressed as percentage). In addition to these parameters- peak expiratory flow rate (PEFR), and forced mid expiratory flow (FEF25%–75%) were calculated. The interpretation of the values will be evaluated by the ATS / ERS guidelines. After performing the test Lung age will be calculated by using the given formula. The calculation of estimated lung age was automatically performed and adjusted by computer during spirometry. Minimum lung age was pre-established at 20 years, whereas maximum lung age was the highest value obtained from the original formula for calculating lung age. For men: Lung age = \(2.87 \times \text{height} - (31.25 \times \text{obtained FEV1}) - 39.375\). For women: Lung age = \(3.56 \times \text{height} - (40.00 \times \text{obtained FEV1}) - 77.28\). Lung age is expressed in years, height is expressed in inches (1 inch = 2.54 cm), and FEV1 is expressed in liters\(^{(2)}\). All the collected data was entered in Microsoft Excel sheet and then transferred to SPSS software version. 17 for analysis. Qualitative data was presented as frequency and
percentages and analyzed using one way ANOVA. Quantitative data was presented as mean and SD and compared by t-test. P-value < 0.05 was taken as level of significance.

RESULTS AND ANALYSIS: Among the total 150 enrolled students, 72 (48%) were obese and 78 (52%) were non-obese. There was a significant increase (p<0.05) in the mean values lung age and differences in obese young adults compared to non-obese. The other PFT parameters i.e., FVC, FEV1, PEFR, FEF25%-75% showed significant decrease in obese young adults compared to non-obese.

<table>
<thead>
<tr>
<th></th>
<th>Numbers</th>
<th>BMI</th>
<th>Waist-Hip ratio</th>
<th>Lung age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese men</td>
<td>44</td>
<td>32.5±2.98</td>
<td>0.93±0.18</td>
<td>69±26.8</td>
</tr>
<tr>
<td>Obese women</td>
<td>28</td>
<td>33±2.72</td>
<td>0.91±0.22</td>
<td>76.2±15.4</td>
</tr>
<tr>
<td>Non-Obese men</td>
<td>44</td>
<td>22.52±3.52</td>
<td>0.93±0.04</td>
<td>54.6±20.13</td>
</tr>
<tr>
<td>Non-Obese women</td>
<td>34</td>
<td>25.2±5.47</td>
<td>0.87±0.05</td>
<td>58±20.25</td>
</tr>
</tbody>
</table>

[Table-1] The mean values of BMI, Waist-Hip ratio and lung age differences among the obese and non-obese individuals.
TABLE 2: Independent t-test comparing anthropometric and pulmonary function test in obese and non-obese young adults

DISCUSSION: The concept of lung age was established with the objective of becoming a tool of awareness of the premature damage that obesity does to the lungs. Studies show that obese subjects have higher levels of biomarkers of oxidative stress. The chronic oxidative stress in obesity promotes the development of organ lesions, such as cardiovascular disease and airway changes with reduced lung function. The measurement of lung age suggests an identification of the pulmonary impairment of individuals with morbid obesity before they present spirometric or respiratory disorders.[5]. In the obesity group, we observed that the lung age increases 15.85% eventually compared with the chronological age. But in the non-obese group there were no significant changes. Hence in this study Lung age correlates positively and significantly with BMI and chronological age. The formula used to predict the lung age was established by Morris and Temple whose study underestimated the lung age of smokers and non-smokers in approximately two decades. Pulmonary aging related to obesity was also observed in the study by Mitsumune et al., which investigated the relationship among lung age, cigarette smoking, and BMI, and verified that a higher BMI was significantly associated with older lung age, regardless of cigarette addiction[5]. In the present study, there was a positive correlation between the lung age and chronological age. As the age increases, structural changes also occur in the lung parenchyma and airways, as well as in the rib cage and respiratory muscles. Also there was a positive correlation among the lung age, body mass, and BMI. A correlation of lung age with BMI was also observed by Melo et al. With exception of this last study, the association between aging of the lung and anthropometrics variables was not found in the literature. Most studies have sought to relate anthropometric variables and lung volumes, thus the importance of the present study analyzing lung age for people differentiated with obese and non-obese individuals was emphasized. There was a significant negative correlation among the FEV1/FVC. Moreover, this variable was found reduced compared with the obese group[5].

CONCLUSION: In present study it has been concluded that obesity with increasing BMI have direct effect on lung aging process along with reducing lung volumes leading to airway/restrictive lung disease in their future.

REFERENCES:

http://doi.org/10.36295/ASRO.2020.232214