A Comparative Study on Variations in Pulmonary Function Tests Among Smokers and Non-Smokers of Bhaktapur, Nepal

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ABSTRACT

Background: Pulmonary function test is a routine procedure for the assessment and evaluation of respiratory disorders. Aims and objectives: To know the variations in the values of the forced vital capacity (FVC), peak expiratory flow rate (PEFR), forced expiratory volume in the first second (FEV1), and FEV1/FVC percentage among smokers and non-smokers. Methods: A cross-sectional study was conducted at Kathmandu Medical College, Nepal. Two hundred and twenty healthy male smokers and non-smokers were included in the study. Data from 220 male subjects (110 smokers and 110 non-smokers) were taken and analyzed. Results: Mean FVC, FEF25-75, FEV1, FEV1/FVC% and PEFR were found to be significantly lower in smokers than the non-smokers; there were significant differences between mean PFT values among smokers and non-smokers (P < 0.05). Conclusion: The mean FVC, FEV1 and PEFR were lower in smokers. Health awareness and educational campaigns are needed to keep the society to avoid smoking and to reduce respiratory diseases.

Keywords: Smoking, Pulmonary Function Test (PFT), Non-smokers

1. INTRODUCTION

Tobacco smoking is rising in developing countries, by 2030 it is expected to have 7 million deaths annually from tobacco use in this part only\(^1\). The WHO stated that tobacco smoking killed 100 million people globally in the 20th century and warned that it could kill one billion people around the world in the 21st century. Smoking and its related diseases kill one in ten adults worldwide and is the single largest cause of premature death. It is a vital etiologic factor in cardiac disease, stroke and lung disease. There is strong evidence of the harmful effect of passive smoking as well\(^2,3\).

The classification criteria as suggested by WHO4 (1998) is\(^4\):

- Smoker: Someone who, at the time of the study, smoke daily tobacco products either daily or occasionally.
- Non-smoker: Someone who, at the time of the study, did not smoke at all.
- Ex-smoker: Someone who was formerly a daily or occasional smoker, but currently does not smoke at all.

Pulmonary function test helps in assessing the presence or absence of obstructive, restrictive or mixed pulmonary diseases for effective and proper management. The harmful effects of cigarette smoking on pulmonary physiology
have been reported by many researches. Cigarette smoking is the causative factor for COPD and pulmonary related carcinoma. Tobacco smoking is a well recognized culprit for the development of coronary heart diseases, angina pectoris and cardiac arrest. Tobacco smoke contains 60 known carcinogens which can lead to lung cancer. The major known compositions of tobacco smoke include Acetone, Arsenic, Butane, Cadmium, Carbon monoxide, Naphthalene, Hydrogen Cyanide and Vinyl chloride. Cigarette smokers therefore, have a high rate of mortality due to lung cancer. Cigarette smoking has an extensive effect on the respiratory physiology and can cause diseases like chronic bronchitis, emphysema, and lung carcinoma. Nicotine affects the CVS by stimulating and then paralyzing all the ganglia causing cardiac slowing, followed by the increase in the heart rate. Cigarette smokers have a higher prevalence of declining in FEV1 and a greater COPD mortality rate than non-smokers. These differences between smokers and non-smokers are directly proportional to the quantity of smoking. Smoking leads to gradual decline in pulmonary function tests (PFTs) specially those concerning with diameter of the airways such as forced expiratory flow in one second (FEV1), FEV1/FVC, PEFR, PEFR25-75%, MVV. Nicotine affects the respiratory physiology, the subjects were asked to sit comfortably. The complete procedure was explained and informed consent was taken. The subjects were told to breathe fully by deep inspiration and after that, with their nostrils closed, sealing their lips, were asked to forcefully expire air out. The best three readings were recorded and analyzed. PFT curves were recorded and FVC, FEF, PEFR, FEV1, FEV1/FVC ratio were obtained.

3. RESULTS

The physical variables of the smokers and the non-smokers are shown in Table 1. Age range of the subjects was 21 – 38 years with mean age of smokers 27.45 ± 6.56 and of non-smokers 26.45 ± 6.44. Mean height of smoker group was 1.67 ± 0.13 meter and of non-smoker group was 1.68 ± 0.13 meter. Whereas, mean weight of smokers was 66±7.67 Kg and non-smokers was 64±5.65 Kg. Total of 210 males, 110 smokers and 110 non-smokers matched for age, height, weight were enrolled in this study. From the result, the FEV1, FVC, FEF, FEV1/ FVC ratio were obtained and analyzed. The mean difference in values for pulmonary function was highly significant (P < 0.05) between smokers and non-smokers. The mean FVC in smokers was 1.80 ± 0.70 L and in non-smokers was 2.92 ± 0.39 L (Table 2). The decrease in FEV1 in smokers (1.26 ± 0.54 L) as compared to non-smokers (2.50 ± 0.39 L) clearly indicates the obstructive pulmonary disease (Figure 1&2).

Table 1: Physical characteristics of smokers and non-smokers.

<table>
<thead>
<tr>
<th>S No</th>
<th>Variables</th>
<th>Smokers (Mean ± SD)</th>
<th>Non-smokers (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age(Years)</td>
<td>27.45 ± 6.56</td>
<td>26.45 ± 6.44</td>
</tr>
<tr>
<td>2</td>
<td>Height(meters)</td>
<td>1.67 ± 0.09</td>
<td>1.68 ± 0.13</td>
</tr>
<tr>
<td>3</td>
<td>Weight(Kg)</td>
<td>66±7.67</td>
<td>64±5.65</td>
</tr>
</tbody>
</table>
Table 2: Comparison of variations in pulmonary function test (PFT) among smokers and non-smokers

<table>
<thead>
<tr>
<th>S No</th>
<th>Pulmonary Function Test</th>
<th>Smokers (Mean ± SD)</th>
<th>Non-smokers (Mean ± SD)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FVC (L)</td>
<td>1.80 ± 0.74</td>
<td>2.92 ± 0.70</td>
<td>P &lt; 0.05</td>
</tr>
<tr>
<td>2</td>
<td>FEF_{25-75} (L/S)</td>
<td>1.33 ± 0.48</td>
<td>2.83 ± 1.02</td>
<td>P &lt; 0.05</td>
</tr>
<tr>
<td>3</td>
<td>PEFR (L/S)</td>
<td>3.45 ± 0.37</td>
<td>5.47 ± 0.40</td>
<td>P &lt; 0.05</td>
</tr>
<tr>
<td>4</td>
<td>FEV1 (L)</td>
<td>1.26 ± 0.54</td>
<td>2.50 ± 0.39</td>
<td>P &lt; 0.05</td>
</tr>
<tr>
<td>5</td>
<td>FEV1/FVC (%)</td>
<td>71.58 ± 13.84</td>
<td>85.14 ± 14.54</td>
<td>P &lt; 0.05</td>
</tr>
</tbody>
</table>

The difference in values of FVC, FEF_{25-75}, PEFR, FEV1, FEV1/FVC ratio found in two groups was significant (P < 0.05)

Figure 1: Mean Forced Vital Capacity (FVC) and FEV1 compared between smokers and non-smokers

Figure 2: Mean Forced Expiratory Flow between 25% to 75% (FEF_{25-75}) and (Peak Expiratory Flow Rate) PEFR compared between smokers and non-smokers
4. DISCUSSIONS

Pulmonary Function Test (PFT) is a routinely performed lung test and is vital tool in clinical diagnosis and investigations of respiratory diseases. The interpretation of respiratory function varies on the comparison of the values obtained from a normal healthy population of the similar physical characteristics. Even in young adults who have smoked only a few years, expiratory flow-volume curves reveal decreases in flow rates at small lung volumes indicating small air-way obstruction. Until now, one of the well stated acute effect of smoking on the airways was the decrease of air-way conductance discovered by Nadel and Comroe\(^\text{14,15}\). In our study the tendency was the reduction in the values of PFT in smokers which showed similar trends to the study done by Wihelmensen and Tibblin\(^\text{16}\), who reported that the PFT showed uniform deterioration in smokers. In a study done by M.S. Islam\(^\text{17}\) found changes of ventilator functions among smokers and non-smokers and found fall in FVC amongst the smokers. Also the MEF25-75% was significantly reduced amongst smokers. Like our study, Nighute S and Awari\(^\text{18}\) found obstructive lung abnormality as a common finding in smokers.

5. CONCLUSION

It has been proved that most lung diseases and many lung cancers are caused by smoking. Other lung diseases related to smoking are emphysema and chronic bronchitis. Individuals who are smokers often have more colds, pneumonia and flu than those who do not smoke. So, smoking has become major health problems not only in Nepal but also worldwide. Society orientated awareness campaign and preventive measures should be well established in order to make people healthy.

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REFERENCES