Comparative Study of Peak Expiratory Flow Rate in Smokers and Non Smokers

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ABSTRACT
Introduction: Peak expiratory flow rate (PEFR) is a simple index of pulmonary function and can be used in researches, clinical practices and even under field conditions to assess status of large airways. Objectives: The current study was undertaken to compare PEFR in smokers and non smokers, to know the effect of duration of smoking and type of smoking on respiratory tract.

Materials and Methods: Study was conducted on 60 healthy male smokers and 60 healthy male non smokers. PEFR recording was done using Wright’s peak flow meter. Statistical analysis was done using unpaired t-test and ANOVA tests. Results: The mean PEFR increased up to the age of 40 years and then gradually decreased after 40 years in both smokers and non smokers. Mean PEFR values were significantly lower in smokers than non smokers in all age groups. The mean PEFR among smokers ranged from 408 L/min to 532.22 L/min where as from 481.43 L/min to 574.61 L/min in nonsmokers. Mean PEFR values decreased significantly as duration of smoking increased. Conclusions: In conclusion the present study revealed, a significant association between reduction in PEFR with advancing age after 40 years. Tobacco smoking in any form, (beedi, cigarette or both) has significant deleterious effects on respiratory tract. Smokers even if they are symptom free, have lower values of PEFR than non smokers. The diminution of PEFR runs more or less in parallel with the duration of smoking. Beedi smoking affects respiratory tract more adversely than cigarette smoking. Early detection of air flow obstruction and smoking cessation may result in significant health gain.

KEYWORDS: PEFR, Smokers, Wright’s peak flow meter, Beedi, Cigarette.

INTRODUCTION

Peak expiratory flow rate (PEFR) is a simple index of pulmonary function used in both research and clinical practice[1]. It is effort dependent and reflects the status of the large airways[2]. PEFR can be measured rapidly and easily even under field conditions with the use of a portable light instrument called Wright’s peak flow meter, weighing about 100 grams[3]. Reduction of PEFR is known with various respiratory diseases. PEFR provides a good objective index to confirm diagnosis, control medication and monitor response to treatment[4].

Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries. By 2030 the developing world is expected to have 7 million deaths annually from tobacco use[5]. Various forms of tobacco smoking are prevalent in India including smoking of beedies, cigarettes, cigars like cheroots, cigarillos and hukka. Cigarette smoking predominates in urban areas, where as beedi smoking is the commonest type of smoking in the lower income groups, illiterates and less educated people[6]. It is well known that smoking is the most important causative factor for chronic obstructive pulmonary diseases and bronchogenic carcinoma[7]. Air flow obstruction in tobacco smokers is often diagnosed relatively late. Earlier detection of air flow obstruction and smoking cessation may result in significant health gain[8]. With this back ground, the present study was undertaken to compare PEFR in smokers and non smokers.

MATERIALS AND METHODS

The subjects of the study were 60 healthy male smokers and 60 healthy male nonsmokers, who accompanied the patients attending OPD of a tertiary health care centre. (Shree Hanagal Kumareshwar Hospital and Research Center, Bagalkot). Ethical clearance was obtained by institutional ethical committee.
Inclusion Criteria:

Cases: Healthy male subjects with a history of smoking for more than one year and those who smoke five or more than five cigarettes/beedies per day. Controls: Healthy male subjects with no past, present or passive history of smoking.

Exclusion Criteria:

1) Female subjects. 2) Male subjects with acute/chronic illness or any respiratory illness or those who work in places where lungs are affected by dust or fumes. 3) Male subjects with musculoskeletal, neuromuscular, allergic, or endocrine disorders.

Informed consent was taken from the subjects after explaining the procedure. Information about age, duration of smoking and type of smoking (cigarette, beedi or both) was taken. The PEFR recording was done in the morning hours between 11am to 1pm by using Wright’s peak flow meter. The readings were taken in all the subjects in the standing position. Each subject was told to take a deep breath and then blow into the peak flow meter as forcibly and as fast as he can. Three recordings were taken from each subject and the best value was recorded.

Statistical analysis was done using unpaired t-test and ANOVA. P value<0.05 was taken as statistically significant and <0.001 as statistically highly significant.

RESULTS

Table-1, shows age wise distribution of PEFR±2SD among smokers and non smokers. The mean PEFR increased up to the age of 40 years but gradually decreased in older age group after 40 years in both smokers and non smokers. The mean PEFR among smokers ranged from 408 L/min to 532.22 L/min where as from 481.43 L/min to 574.61 L/min in non smokers. Unpaired t-test showed that the mean values of PEFR were significantly lower in smokers than nonsmokers in all age groups.

Table 1: PEFR values in relation to age and smoking habit

<table>
<thead>
<tr>
<th>Age Group</th>
<th>SMOKERS</th>
<th>NON SMOKERS</th>
<th>t-Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 20</td>
<td>08</td>
<td>495 ± 111.1</td>
<td>4.619</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>21-30</td>
<td>12</td>
<td>515.83 ± 150.5</td>
<td>2.33</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>31-40</td>
<td>18</td>
<td>532.22 ± 86.92</td>
<td>2.20</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>41-50</td>
<td>17</td>
<td>452.94 ± 83.58</td>
<td>4.75</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≥ 51</td>
<td>05</td>
<td>408 ± 53.66</td>
<td>5.134</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Unpaired t-test, S- significant, H S- Highly significant

It can be observed from table-2 that mean PEFR values decreased with increasing duration of smoking and ANOVA test showed that the difference in PEFR values between all the age groups were statistically highly significant (P<0.001).

Table 2: PEFR values in relation to duration of Smoking

<table>
<thead>
<tr>
<th>Duration of smoking in years</th>
<th>N</th>
<th>PEFR(Mean ± 2SD)</th>
<th>F VALUE</th>
<th>P VALUE</th>
<th>Statistical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5</td>
<td>22</td>
<td>545 ± 58.14</td>
<td>17.63</td>
<td>0.0000</td>
<td>&lt; 0.001 Highly significant</td>
</tr>
<tr>
<td>6-10</td>
<td>26</td>
<td>471.92 ± 120.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-15</td>
<td>07</td>
<td>452.86 ± 95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥16</td>
<td>05</td>
<td>408 ± 62.28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PEFR±2SD values among cigarette, beedi and cigarette+beedi smokers are compared in table-3. Mean PEFR value was much lower among beedi smokers than only cigarette smokers and ANOVA test revealed that the difference was statistically highly significant (P<0.001) between all the three groups.

Table 3: PEFR values in relation to type of Smoking

<table>
<thead>
<tr>
<th>Type of smoking</th>
<th>N</th>
<th>PEFR(Mean ± 2SD)</th>
<th>F VALUE</th>
<th>P VALUE</th>
<th>Statistical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only cigarette</td>
<td>38</td>
<td>520.78 ± 105.76</td>
<td>18.27</td>
<td>0.0000</td>
<td>&lt; 0.001 Highly significant</td>
</tr>
<tr>
<td>Only beedi</td>
<td>18</td>
<td>433 ± 28.28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarette+Beedi</td>
<td>04</td>
<td>470 ± 102.44</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

During last few decades, lung function tests have evolved from tools for physiological study to clinical investigations in assessing status of respiratory tract[9]. Narrowing of the air ways reduces the ability to move air in and out of the lungs. The narrower the tubes, the lower will be the PEFR[10]. The present study showed an increase in mean PEFR values up to 40 years and decrease in mean PEFR values with increasing age after 40 years in both smokers and nonsmokers. This could be due to the strength of chest muscle contraction which improves with age in younger age group and decreases as the age advances. These findings are in agreement with the findings of other studies[11-13]. Mean PEFR values were consistently lower among smokers than non smokers in all age groups and the difference was statistically significant in all age groups. Various authors have reported similar findings in their study[14-17].

Smoking tobacco in any form causes irritation of respiratory tract which in turn causes hypertrophy of mucosal cells resulting in increased secretion of mucus and formation of mucosal plugs. Mucosal plugs cause obstruction to exhaled air[18]. Other factors involved in narrowing of respiratory tract in smokers are bronchoconstriction, activation of inflammatory cells[19], loss of elastic recoil of lungs[18] slowing of the movement of cilia thus making mucociliary clearance difficult[20] and angiogenesis in respiratory tract[21]. Contrary to the findings of the present study, Tinker study (1962) did not notice any significant difference between mean PEFR values of smokers and non smokers[22] and it is of interest to note that values of mean PEFR were little higher in smokers than nonsmokers in the age group of 21-30 years in a study done by Jain SK et al in 1982[23].

These observations can be explained by the fact that the duration of smoking in young individuals is less and young adults can easily compensate the damage done by smoking. The mean PEFR reduced significantly as the duration of smoking increased. This could be due to accumulated adverse effects of tobacco smoke on respiratory tract over a period of time. Similar finding are reported by other investigators also[23,24].

PEFR was also significantly lower in beedi smokers than cigarette and both cigarette+beedi smokers. This can be accounted on the basis of excess amount of carbon monoxide, tar and other toxic constituents present in the smoke of the beedi[25]. Similar findings are reported by studies done by Padmavathi et al[7], Rubeena Bano et al[24], and Jain S.K et al[23].

CONCLUSIONS

In conclusion the present study revealed, a significant association between reduction in PEFR with advancing age after 40 years. Tobacco smoking in any form, (beedi, cigarette or both) has significant deleterious effects on respiratory tract. Smokers even if they are symptom free, have lower values of PEFR than non smokers. The diminution of PEFR runs more or less in parallel with the duration of smoking. Beedi smoking affects respiratory tract more adversely than cigarette smoking. Early detection of air flow obstruction and smoking cessation may result in significant health gain.

REFERENCES


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