INTRODUCTION:
Air conditioning may affect the human health since it has profound effect on our environment than just lowering temperature. Hyperventilation of cold dry air causes bronchoconstriction in asthmatic patients. Cold dry air is what we inhale while using AC’s; hence alteration in pulmonary functions may also be simulated in AC users. Modern style of living in urban area is responsible for airway allergic diseases.

OBJECTIVE:
This study was planned to observe the effect of air condition (AC) on pulmonary functions.

MATERIALS AND METHODS:
The study group contain 30 subjects who were using AC in their cars for at least 2 hours daily since last 6 months and 30 subjects who did not use AC as a controls. All the subjects are male and age group between 20 to 30 years. The pulmonary functions were assessed using spirometer in room.

Experimental protocol was explained and consent was taken. History was taken and clinical examination (general and systemic) done for inclusion and exclusion criteria. Statistical analysis was done by unpaired t test. P value less than 0.05 considered as a significant.

RESULT:
Age, Height and Weight are not statistically significant in study group and controls. Forced vital capacity (FVC) and Forced expiratory volume in 1 second (FEV₁) are not significant in both group. Peak expiratory flow rate (PEFR), Forced expiratory flow (FEF) are significantly decreased in AC users. FEF₂₅-₇₅% which is the flow rate over the middle half of the forced vital capacity (FVC) is significantly decreased in AC users.

CONCLUSION:
Significant decrease in PEFR and FEF₂₅-₇₅% in AC users predispose towards the mild respiratory limitation.

KEY WORDS: Air conditioner, PEFR, FEF₂₅-₇₅%, Pulmonary functions, FEV₁

MAIN ARTICLE

INTRODUCTION:
One of the component in modern lifestyle is intensive use of AC’s, which has increased the risk of atopic sensitization. Air conditioners (AC) are used extensively these days indoor as well as while travelling. The air inside is cooled at the expense of air outside. The reduction in humidity of the air being cooled is due to the condensation of water vapours. It has been observed that hyperventilation of cold dry air causes bronchoconstriction in asthmatic patients. Modern styles
of living in urban areas have been considered potentially responsible for the development of airway allergic diseases due to proliferating house dust mites & increasing concentration of indoor air pollutants, which lead to the elevation of serum IgE levels or the enhancement of eosinophil activity. (1, 2)

Increased prevalence of IgG induced sensitization and hypersensitivity pneumonitis is reported in persons exposed to aerosols of contaminated AC's. While fluorinated hydrocarbons collectively referred as Freon have been shown to result in widespread toxicity after accidental or intentional inhalation. Freon inhalations may lead to the production of cardiac arrhythmias. (3) Freon primarily serve as propellants and are widely used in cooling systems. Therefore we planned to evaluate the lung function tests of young healthy non-smokers using car AC's.

MATERIALS AND METHODS:
The study group contain 30 subjects who were using AC in their cars for at least 2 hours daily since last 6 months and 30 subjects who did not use AC as a control. All the subjects are male and age group between 20 to 30 years. The pulmonary functions were assessed using spirometer in room.

Experimental protocol was explained and consent was taken. History was taken and clinical examination (general and systemic) done for inclusion and exclusion criteria.

INCLUSION CRITERIA:
(1) Male with age group of 20-30 years.
(2) Healthy individual without any known disease.
(3) No history of drug, smoking or any condition that affect pulmonary functions.

EXCLUSION CRITERIA:
(1) Individual with any known general or systemic disease.
(2) Any history of drug or addiction that affect the pulmonary functions.
(3) Using AC on irregular basis.
(4) Any un co-operative subject.

EXPERIMENTAL PROTOCOL:
(1) All the subjects filled the consent form that they are willing to participate in the study.
(2) History and clinical examination was done for inclusion and exclusion criteria.
(3) Pulmonary function test was done by spirometer in room with sitting posture and using nose clip.
(4) Then mean value and standard deviation was estimated by statistical method.

PROCEDUR:
(1) Pulmonary function test was done by spirometer with inbuilt computer program.
(2) The subject was given proper instruction by us for procedure.
(3) Subject was seated in comfortable seating position.
(4) Mouthpiece and nose clip applied to subject during procedure.

STATISTICAL ANALYSIS:
Unpaired t test is used for analysis and P value less than 0.05 consider as a significant.
RESULT:
Data presented are Mean ± SD (standard deviation)

**Table 1: Anthropometric parameters**

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>AC USERS</th>
<th>NON AC USERS</th>
<th>SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>24.32 ± 1.63</td>
<td>24.18 ± 1.64</td>
<td>NS</td>
</tr>
<tr>
<td>Height (cms)</td>
<td>164.68 ± 9.42</td>
<td>165.22 ± 8.63</td>
<td>NS</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>62.72 ± 5.95</td>
<td>62.84 ± 6.77</td>
<td>NS</td>
</tr>
</tbody>
</table>

S: Significant (P value less than 0.05)
NS: Not significant (P value more than 0.05)

**Table 2: Lung volumes and capacities (liters)**

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>AC USERS</th>
<th>NON AC USERS</th>
<th>SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV\textsubscript{1}</td>
<td>3.34 ± 0.74</td>
<td>4.09 ± 1.13</td>
<td>NS</td>
</tr>
<tr>
<td>FVC</td>
<td>3.79 ± 0.86</td>
<td>4.22 ± 1.26</td>
<td>NS</td>
</tr>
<tr>
<td>FEV\textsubscript{1}/FVC</td>
<td>90.41 ± 15.87</td>
<td>97.46 ± 0.93</td>
<td>NS</td>
</tr>
</tbody>
</table>

**Table 3: Pulmonary flow rates (liters/min)**

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>AC USERS</th>
<th>NON AC USERS</th>
<th>SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEFR</td>
<td>6.18 ± 2.30</td>
<td>9.05 ± 3.57</td>
<td>S</td>
</tr>
<tr>
<td>FEF\textsubscript{25%}</td>
<td>5.66 ± 2.48</td>
<td>8.51 ± 2.97</td>
<td>S</td>
</tr>
<tr>
<td>FEF\textsubscript{75%}</td>
<td>2.92 ± 1.08</td>
<td>3.92 ± 0.82</td>
<td>S</td>
</tr>
<tr>
<td>FEF\textsubscript{25-75%}</td>
<td>4.38 ± 1.66</td>
<td>6.05 ± 1.27</td>
<td>S</td>
</tr>
</tbody>
</table>

Age, Height and Weight are not statistically significant in study group and controls. Forced vital capacity (FVC) and Forced expiratory volume in 1 second (FEV\textsubscript{1}) are not significant in both group. FEV\textsubscript{1}/FVC ratio is also not significant. Peak expiratory flow rate (PEFR), Forced expiratory flow (FEF) are significantly decreased in AC users. FEF\textsubscript{25-75%} which is the flow rate over the middle half of the forced vital capacity (FVC) is significantly decreased in AC users.

**DISCUSSION**
The results of the present study show a predisposition of AC users towards respiratory dysfunction. (9) There is a definite impairment in the expiratory flow rates especially the FEF\textsubscript{25-75%}, which is the flow rate over the middle half of the forced vital capacity (FVC), In the presence of normal FEV\textsubscript{1}, reduced FEF\textsubscript{25-75%} is an evidence for mild airflow limitation. This index is recommended as a screening test for mild airflow limitation.

PEFR reflects mainly the caliber of the bronchi and larger bronchioles, which are subjected to reflex bronchoconstriction. Bronchoconstriction in asthmatic subjects has been reported on hyperventilation of cold dry air. (3, 4, 5)
All the subjects of the present study were driving their cars themselves, the direction of the blow of air was directly on their face, which may be one of the reasons for these changes. (6) Repeated cooling and dessication of peripheral airways can cause airway remodeling similar to that seen in asthma. Crude water extracts of contaminated AC’s are the antigen-source of the hypersensitivity pneumonitis. (7, 8)

Our subjects used AC’s in their cars during the hot humid environment, which is the climate prone for the growth of various allergens. Further studies are require on large scales basis for confirmation of our study.

CONCLUSION
Significant decrease in PEFR and FEF25-75% in AC users predispose towards the mild respiratory limitation.

REFERENCES


