

Pulmonary Function Tests in Professional Air Conditioner Users

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Abstract: The respiratory effects of exposure to air conditioner have been investigated in numerous studies; but results of these studies have not been consistent. The aim of the present study was to investigate the respiratory effects of air conditioner exposure in a group of air conditioner users. The 35 air conditioner users were subjected to spirometry to assess the respiratory functions. Forced expiratory volume at the end of one second i.e. FEV1 and forced vital capacity i.e. FVC were considered. In the present study, 10 subjects were showing the FEV1/FVC ratio less than 0.7 and 25 subjects were showing the ratio more than 0.7. This indicates that 10 subjects tend to have obstructive respiratory pathologies and 25 were having either normal or restrictive respiratory pathology. Prolonged air conditioner use may impair respiratory function. It is concluded that air conditioner users are at risk of respiratory dysfunction.

Key words: Air conditioner FEV1 FVC

I. Introduction

Use of Air Conditioners (AC) has become very common in recent days. This is especially so in people who work for Multinational Companies. Use of Air Conditioners is known to cause decrease in lung function parameters in normal individuals.

Air conditioners' purpose is to provide comfort during either hot or cold weather. However, air conditioning is not only destructive to the environment, but also harmful to health. We use air conditioning to cool our little microenvironment, house, car, office, whatever it may be, but in so doing, we pump out heat and harmful gases into the external environment, thus contributing to global warming^[1]. Hyperventilation in cold air induces bronchoconstriction which may be as a result of repetitive dehydration of small airway when large volume of cold air is inhaled^[2,3].

In the modern lifestyle, use of AC had become very common. We are inhaling cold dry air while using AC due to which alteration may occur in pulmonary function. There are very few studies showing the effect of AC on various pulmonary functions. Hence, we undertook this study to see the alteration in pulmonary function test (PFT) with the use of AC in healthy non-smokers.

II. Material And Methods

The study was approved by IEC (ECR/472/Inst/MH/2013 dated 22/1/2015). The cross sectional study was conducted on 35 males using air conditioner for 8 hrs a day for 5 days in week for a period of 2 years. The procedure was explained to subjects and written informed consent was taken. These subjects were HDFC bank employees. All were nonsmokers. The age group was 25-50 years. The pulmonary function tests were performed using Medspiror Electronic Spirometer. The tests were performed in sitting position. The forced expiratory volume at the end of first second (FEV1) and forced vital capacity (FVC) were assessed.

The actual values are converted into percentage of predicted values to eliminate the effect of age, height and weight.

Inclusion criteria

- Age: 25-50 years
- Healthy, non-smoker
- Exposure to AC for 24 months : Subjects were exposed to AC for 8 hrs in day for 5 days in a week.

Exclusion criteria

- Smokers
- H/o chronic respiratory disease
- H/o cardiac disease
- Examination finding suggestive of respiratory or cardiac disease

III. Results

The results of present study showed in 35 subjects the mean percentage predicted of forced expiratory volume at one second was 68.37 ± 7.34 and forced vital capacity was 70.48 ± 6.89 . [Table 1]

We got obstructive pathologies in 10 subjects whereas 25 subjects showed either restrictive or normal pattern. [Table 2]

IV. Discussions

To categorize the pattern and severity of the condition as a 1st step, FEV1/FVC ratio was assessed. If this ratio is less than the lower limit of normal for the patient (included with the test report), obstructive defect is present (i.e. FEV1 has fallen to a greater degree than the FVC). If the ratio is greater than the lower limit of normal then either spirometry test is normal or restrictive defect is present. In this situation if only spirometry is available, the next step is to look at the FVC. If the FVC is less than the normal, a restrictive defect is suggested. The total lung capacity (TLC) can confirm the restriction if this value is less than the predicted lower limit of normal (if TLC was measured)^[4].

In the present study, the FEV1/FVC ratio less than 0.7 the subjects were 10 and more than 0.7 were 25. This indicates that 10 subjects tend to have obstructive respiratory pathologies and 25 were having either restrictive respiratory pathologies or normal^[5].

The results of the present study showed the predisposition of AC users toward respiratory dysfunction; also, the incidence of respiratory symptoms was higher among the AC users. FVC provides useful information about the strength of respiratory muscle,^[6] therefore maximum inspiratory and expiratory effort can be assessed with it. FEV1 is a much more sensitive index for severity of obstructive lung disease^[6,7].

Study by Keele CA et al, PEFr depends on the expiratory efforts exerted during forceful expiration as well as status of airways, and it reflects mainly the caliber of the bronchi and larger bronchioles, which are subjected to reflex bronchoconstriction^[8]. Thus, respiratory dysfunction observed in the AC user is more like obstructive pattern. Maximum midexpiratory flow rate, i.e. FEF25-75% is a sensitive indicator of small airway disease where most of the chronic obstructive pulmonary diseases start^[8].

V. Conclusions And Recommendations

We recommend further studies to be performed with larger sample size. Also, more parameters should be included like humidity level, culture swab from AC to know the growth of bacteria and fungi, and different measures for maintenance.

Thus, to conclude, AC users are more at risk of respiratory dysfunction. Respiratory dysfunction may be because of the coldness of the aerosol of the AC. Other factors responsible may be different allergens, infections, and humidity level. Thus, the technical, hygienic, and microbiological features of air intake must be better ensured in order to avoid the air intake becoming a risk component as regards contamination and indoor air quality.

Table 1: Showing Spirometry parameters and percentage of predicted values:

Sr No	Spirometry parameters	Percentage of predicted values (Mean ±SD)
1	FEV1	68.37±7.34
2	FVC	70.48±6.89

Table 2: Showing FEV1/FVC ratio:

Sr no	No of subjects having FEV1/FVC <0.7 (Obstructive pathology)	No of subjects having FEV1/FVC >0.7 (Restrictive pathology or normal)	Total no of subjects
1	10	25	35

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