

Pulmonary ventilation in air conditioner users in Pravara Rural Hospital

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Abstract

To study the effect of air conditioner (AC) on pulmonary functions in Pravara Rural Hospital and Medical College, Loni (Maharashtra), 60 healthy males between the ages of 25-40 years were considered. Among these, 30 were AC users (at least 06 hours /day), since last 06 months and were considered as experimental group. The control group consisted of 30 non AC users of same age group. Pulmonary ventilation in both the groups was assessed using computerized spirometer (RMS Meidispiror) and the data statistically analyzed by using 'Z' test. The study found that the pulmonary ventilation in AC users especially Peak Expiratory Flow Rate (PEFR), Timed Vital Capacity and Maximum Voluntary Ventilation (MW) was significantly reduced ($P < 0.05$) while in the control group there was no such decrease in the pulmonary ventilation. The results of experimental group show early small airway obstruction. The study suggests predisposition of AC users to respiratory disorders in the form of the mild airway restriction.

Key Words: Air conditioners, timed vital capacity, PEFR, MW.

Introduction

In the 20th century, air conditioners (AC) are one of the luxurious needs of human beings. It is used in various fields such as hospitals, colleges, offices, and information technology institutions, cinema theaters, vehicles, railways, buses and so on. Our study conducted in Pravara Rural Hospital and College (Pravara Rural University), Loni, showed that people working continuously in AC environment complain about cardio-respiratory problems. A review of literature also shows that hyperventilation of cold dry air causes bronchoconstriction in asthmatic patients[1-2]. Some of the researchers have also shown that, continuous use of AC cause atopic sensitization[3-4]. A few authors have reported that there is decrease in eosinophil activity[5-6], but there is controversy regarding the effects of AC on the various systems of the body. Air conditioners cool and dry the air and when a person is exposed to cool dry air for long periods of time and is then immediately exposed to warm air, it causes a sudden change in the

environment which is most likely to have a long term effect on the body directly or is it possible that the adaptation of the body systems to the environment are affected? To find out answers the present study was undertaken in Pravara Rural Hospital and Medical College, Loni, Maharashtra.

Aims and objectives

1. To study the pulmonary function tests (FEVC, FEV₁/FVC, MW) in AC and non AC users.
2. To compare the values of pulmonary function tests between AC users and non AC users.

Material and methods

1. Selection of the subjects: Normal healthy volunteers: 60 in number, all male, in the age group of 25-40 years, and free from respiratory diseases.

2. Selection of the test : Professional workers of Pravara Rural Hospital and Medical College, Loni, were selected for the study. Thirty subjects who were AC users for at least 06 hours / day since last 06 months, were considered as the experimental group. The control group consisted of 30 AC non users. Recordings were carried out in the afternoon between 2-5 pm in the experimental group[3]. Exclusion criteria were:

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1. Presence of any acute or chronic respiratory disorder.
2. Systemic illness which directly or indirectly affected the respiratory system.
3. Smokers.
4. Users of AC's on irregular basis.

Anthropometrical measurements including age, height and weight were recorded.

The pulmonary function test was carried out using computerized spirometer (RMS Medispiror) from College of Physiotherapy, Loni. A questionnaire was required to be filled up and relevant data (name, age, sex, height, weight, smoker/nonsmoker) was entered in the computer. The subject was given proper instructions about the procedure to be performed. All the pulmonary function tests (FEVC, FEV, FEV, / FVC, MVV) were carried out on the subjects comfortably seated in an upright position. The subject held the mouthpiece and was asked to breath in order to familiarize himself with the equipment. During the tests the subjects were adequately encouraged to perform at their maximum level . A nose clip was applied during the entire procedure. The outcome of pulmonary function tests was measured as mean ± SD for each of the parameters. The experimental and control groups were compared by applying unpaired 't' test and a P- value of less than 0.05 was considered as significant.

Observations and results

Table I: Anthropometric Parameters

Parameters	Mean ± SD	
	Group 1	Group II
AC user	Non-AC user	
Age	31. 30 ±3.405	31.63 + 3.728*
Height (cm)	164.00 ±7.386	166.53 + 4.240*
Weight (kg)	62.73 + 6.812	62.9. ±5.944*

* P > 0.05 (non-significant)

The Anthropometric Parameters of the experimental group and control group are shown in Table No. I. No statistical difference was observed between the groups on these parameters. Table No II shows the flow rates of AC users and non users. All the expiratory flow rates were significantly decreased in AC users.

Table II: Flow Rates (Liter / Min.)

Parameter	Mean ± SD	
	Group 1 AC users	Group II Non-AC
PEFR	4.31 + 1.56	8.09 ±1.402*
FEF25	4.10 ±1.283	7.09 ±1.400*
FEF50	2.91 ±1.163	6.64 ±1.470*
FEF75	1.57 ±0.61	33.45 ±1.051*
FEF25,5	2.86 + 0.957	5.73 ±1.135*

* P < 0.05 (significant)

In Table No III the lung volumes and capacities were not significantly different except for forced expiratory volume in 0.5 sec (FEV05), which was significantly decreased in AC users.

Table III: Lung Volumes & Capacities (Liters)

Parameters	Mean ± SD	
	Group 1 AC users	Group II Non-AC users
FEVC	2.29 ± 0.460	3.25 ± 0.358*
FEV	1.56 ±0.591	2.68 ± 0.342*
FEV,	2.076 ± 0.663	3.30 ± 0.377*
FEV / FVC	89.23 + 15.147	104.52 ±20.527*
MVC	125.6 + 7.22	157.17 + 9.777*

*P < 0.05 (significant)

Discussion

The purpose of present study was to examine volunteers using ACs 06 hours / day for last 06 months. Use of AC has shown decrease in flow rates.

The expiratory flow rates especially the FEF 25-75% which is the flow rate over the middle half of forced vital capacity (FVC) showed decrease in our study. In the presence of normal FEV1, decrease FEF 25-75% is evidence of mild airway obstruction[7]. Our values of peak expiratory flow rate (PEFR) were also decreased in the experimental group. PEFR mainly reflects the caliber of the bronchi. Larger bronchi show reflex bronchoconstriction. Bronchoconstriction in asthmatics has been reported in previous studies on hyperventilation of cold dry air[8]. During AC use, cold dry air is inhaled, hence the values of pulmonary functions in AC users are decreased. In order to study the effect of AC on

pulmonary ventilation, subjects sitting in AC for 06 hours / day for last 06 months were selected. Smoking and intensive use of AC appears to be positively related to atopic sensitization and decreased eosinophil activity[4]. Indoor dampness and poor ventilation increases exposure to indoor air pollutants[5]. Other studies have shown that contamination of home / office ACs with fungi causes hypersensitivity pneumonitis[9-10]. The exclusion of particulate allergens by window ACs has also been reported by some of the authors. A study in USA showed that mite allergens detected in the dust samples are reduced by the use of ACs in summers because of their water drainage effects.” Other studies showed that air conditioning could reduce mite density, if relative humidity is reduced below 50%.[12] A Japanese study showed that specific mite populations, including Der p, were higher in homes with ACs.[13] The continuous use of AC reduces indoor absolute humidity with relation to outdoor levels.

Conclusion

From the study it has been observed that the pulmonary ventilation in AC users especially PEFr, Timed vital capacity (FEV) and Maximum Voluntary Ventilation (MW) have been significantly reduced (P 0.05) while in control group there is no such decrease in pulmonary ventilation. The results of the experimental group show early small airway obstruction which is suggestive of predisposition of AC users to respiratory disorders in the form of mild airway restriction. Further studies however, are indicated to evaluate the effectiveness of Air Conditioners on pulmonary ventilation.

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