ORIGINAL ARTICLE

EFFECT OF AIR CONDITIONER ON PULMONARY FUNCTIONS IN HEALTHY MALES IN AND AROUND RAICHUR CITY

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ABSTRACT: INTRODUCTION: Air conditioner by lowering temperature may affect human health since it has profound effect on our environment. 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 Ig E levels or the enhancement of eosinophil activity. **AIMS AND OBJECTIVE:** To assess the effect of air conditioners (AC) on pulmonary functions in young healthy non-smoker male. **MATERIALS AND METHODS**: The study group comprised of 20 male subjects who were using AC's in their cars for at least 1 hr daily since last 6 months. While 20 male subjects who did not use AC at all served as controls. The pulmonary functions were assessed using Power lab 8/30 series with dual bio Amp/stimulator, manufactured by AD instruments, Australia, in a closed room the outcome of pulmonary function tests was presented as a mean ± SD for each of the parameter. The two groups were compared by applying unpaired 't' test and P value of less than 0.05 was considered as significant. **RESULTS:** The peak expiratory flow rate (PEFR) and Forced expiratory flow between 25–75% of vital capacity(FEF25–75) were significantly reduced in subjects using car AC's. **CONCLUSION:** In the presence of normal FEV1, reduced FEF 25–75%, which is the flow rate over the middle half of vital capacity, is an evidence of mild airflow limitation. The result is suggestive of predisposition of AC users towards respiratory disorders in form of mild airflow restriction

KEYWORDS: Air conditioners, Pulmonary functions, PEFR, FEF25–75%, FEV1.

INTRODUCTION: 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 vapors.

Hyperventilation of cold air has gained popularity over the past years as a means of assessing bronchial hyper responsiveness for clinical.[1,2] and epidemiological purposes.[3] It has been observed that hyperventilation of cold dry air causes bronchoconstriction in asthmatic patients.[4,5] Cold dry air is what we inhale while using AC's; hence alteration in pulmonary functions may also be simulated in AC users.

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.[6,7,8] One of the component in modern lifestyle is intensive use of AC's, which has increased the risk of atopic sensitization.[9,10] While the absence of air conditioners and use of hot water heating systems is also reported to have a negative relationship

with FEV1.[11] Increased prevelance of IgG induced sensitization and hypersensitivity pneumonitis is reported in persons exposed to aerosols of contaminated AC's.[12] While fluorinated hydrocarbons collectively referred as freons have been shown to result in widespread toxicity after accidental or intentional inhalation. Freon inhalations may lead to the production of cardiac arrhythmias. Freon's primarily serve as propellants and are widely used in cooling systems.[13]

This study indicate a link between the use of AC's and various cardio respiratory functions. There are very few studies showing the effect of AC's on various pulmonary functions. Therefore the present study was planned to evaluate the lung function tests of young healthy non-smokers using car AC's.

MATERIALS AND METHODS: The present study was conducted in Navodaya Medical College, Raichur, Karnataka.

Students of Navodaya medical College between 18–28 years of age were assessed for their pulmonary functions. The subjects were divided into two groups based upon usage of car AC's. Group I constituted 20 male subjects who were using car AC's for at least 1 hr daily for the past 6 months Recordings were done within one hour of using AC between 9–11 am. While 20 male subjects who did not use AC's either in car or anywhere else constituted group II.

Exclusion criteria were presence of any acute or chronic respiratory disorder, Systemic illness which directly or indirectly affects the respiratory system, Smokers, Use of car AC's on irregular basis or for less than 1 hr daily.

Anthropometrical measurements including age, height and weight were recorded. Further a preliminary clinical examination was carried out on the subjects to rule out any medical problems.

The pulmonary function test was carried out using Power lab 8/30 series with dual bio Amp/stimulator, manufactured by AD instruments, Australia. Marketed by Comtek scientific instruments Bangalore with model no. ML870.The protocol was explained to the subjects and informed consent was obtained from each of the participant. All pulmonary function tests were done on the subjects comfortably seated in an upright position. The subject was connected to the mouthpiece and was asked to breathe in order to familiarize himself with the equipment. During the tests the subject was adequately encouraged to perform at their optimum level and also a nose clip was applied during the entire maneuver. Test was repeated at least 3 times and the best matching results were considered for analysis. Residual volume, Functional residual capacity, Total lung capacity, airway resistance and compliance are derived values, rest all are measured by the machine. The algorithms used for calculation have been validated for Indian populations.

STATISTICAL ANALYSIS: All data is expressed as a mean ± SD for each of the parameter. The two groups were compared by applying unpaired 't' test and P value of less than 0.05 was considered as significant.

RESULTS: The anthropometric parameters of the subjects and the controls are shown in (Table I). No statistical difference was observed between the groups on these parameters.

All the expiratory flow rates were significantly decreased in AC users (Table II). The airway resistance and compliance of the lungs did not show a significant change (Table II).

The lung volumes and capacities (Table III) were not significantly different in the two groups except for forced expiratory volume in 0.5 sees (FEV0.5), which was significantly decreased in AC users.

Parameters	Mean ± SD	
	Group I, AC users	Group II, Non AC
Age (yrs)	20.75±2.33	21.00±2.16
Height (cms)	176.63±7.32	177.29±7.05
Weight (kg)	70.38±8.12	74.51±9.20

Table 1: Anthropometric parameters.

Parameters	Group I, AC users (n=20)	Group II, Non AC (n=20)
PEFR	5.72±3.14	8.67±2.43*
FEF25	5.12±2.48	8.37±2.63*
FEF50	4.37±1.32	6.94±1.74*
FEF75	2.45±1.21	3.89±0.87*
FEF25–75	4.18±1.44	6.43±1.36*
Airway resistance	2.37±1.28	1.92±0.47
Compliance (L)	0.13±0.01	0.12±0.04
*P<0.05		

Table 2: Flow rates (Liter/min) & Lung mechanics

Parameters	Group I, AC users (n=20)	Group II, Non AC (n=20)
FEVC	3.94±043	4.12±1.33
FEV0.5	2.23±0.32	3.29±0.43*
FEV1	3.63±0.52	4.13±1.06
FEV1/FVC	90.67±13.17	95.16±0.67
ERV	0.93±0.16	1.02±0.44
RV	1.07±1.23	0.74±0.12
FRC	1.92±1.69	1.97±1.32
TLC	4.92±1.54	4.89±1.65
MVV	130.44±17.42	133.08±20.74
*P<0.05		

Table 3: Lung volumes & capacities (Liters)

DISCUSSION: The results of the present study show a predisposition of AC users towards respiratory dysfunction. There is impairment in the expiratory flow rates especially the FEF 25–75%, which is the flow rate over the middle half of the forced vital capacity (FVC), In the

presence of normal FEV1, reduced FEF 25–75% is an evidence for mild airflow limitation.[14] Peak expiratory flow rate is also significantly decreased in subjects using AC's. PEFR reflects mainly the caliber of the bronchi and larger bronchioles, which are subjected to reflex bronchoconstriction.[14] Bronchoconstriction in asthmatic subjects has been reported on hyperventilation of cold dry air.[1]

Repeated cooling and dessication of peripheral airways can cause airway remodelling similar to that seen in asthma.[15] Personal smoking and intensive use of AC's appeared to be positively related to atopic sensitization and enhanced eosinophil activity.[10] Probably living conditions, such as indoor dampness and poor ventilation increases the exposure to indoor air pollutants.[6] Crude water extracts of contaminated AC's are the antigen-source of the hypersensitivity pneumonitis in exposed workers[12]. Moreover contamination of home, office and car air conditioners with fungi has been reported to cause hypersensitivity pneumonitis.[16,17]

A study in the USA suggested that mite allergens detected in the dust samples are reduced by the use of air conditioners in summers because of their water drainage effects.[18] Another investigator reported that air conditioning could reduce mite density, if it decreases relative humidity to below 50%.[19] On the other hand a Japanese study found that specific mite populations, including Der p, were significantly higher in homes with air conditioning.[20] The intensive use of air conditioners is likely to reduce the indoor absolute humidity in comparison to the outdoor level. However the relative humidity in a room with AC rapidly increases locally near the wall and floor when the air conditioning stops and the outdoor air enters,[20] because the relative humidity becomes higher as the temperature decreases due to reduced saturated vapor pressure, thus leading to a favourable local climate for mite proliferation. The intensive use of AC's cannot reduce relative humidity below the level of mite survival. But instead creates a mite friendly local environment in the hot and humid climate of the area studied.[10] Our subjects used AC's in their cars during the hot humid environment, which is the climate prone for the growth of various allergens. Most of our car AC users, used AC's even at home hence the domestic factors must also be contributing to the results.

Thus AC does more to our environment than just lowering temperature. AC's and central AC systems can have a profound impact on quality of air we breathe. The technical, hygienic and microbiological feature of air intakes must be better insured in order to avoid the air intake becoming a risk component as regards contamination and indoor air quality.

CONCLUSION: There is impairment in the expiratory flow rates of AC users especially the FEF 25–75%, which is the flow rate over the middle half of the forced vital capacity (FVC), In the presence of normal FEV1, reduced FEF 25–75% is an evidence for mild airflow limitation. This index is recommended as a screening test for mild airflow limitation.

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