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Comparative Evaluation of Lung Functions between Ac and Non Ac users among Student Population

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Background: Usage of air conditioners (AC) has been highly increased in this modern era. In addition to the cooling of the environment, it has a major impact on human health. Rapid influx of cold dry air increases the risk of bronchoconstriction in asthma patients due to the dehydration of the air pathway. So, the present study planned to comparatively evaluate the lung functional status in air conditioner and non air conditioner users.
Materials and Methods: The pulmonary functional capacity was assessed using FVC, FEV1 and FEV1/FVC ratio, Peak expiratory flow rate (PEFR) and FEF 25-75% in a Helios 702 spirometer.
Results: The lung functional capacities among the AC users showed a statistically significant decline in PEFR and FEF25-75% indicating the risk of airway obstruction.
Conclusion: The study concluded an innovative finding that AC users are developing ventilatory dysfunction and are at more risk of respiratory dysfunction. The coldness of the aerosol of the AC unit or other factors responsible may be allergens, infections and humidity level. Thus technical and hygienic features of air intake must be ensured to maintain a good indoor air quality.

Keywords: Air conditioners; innovative; lung functions; peak expiratory flow rate; forced vital capacity.

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1. INTRODUCTION

In this modern and fast evolving world the demand and usage of air-conditioners is highly increased .Almost every workplace, school and home uses air-conditioners [1]. Air-conditioners are used for lowering the temperature it is achieved so by the condition condensation of water vapour thereby reducing the humidity. The hyperventilation of cold air is one of the main reasons for bronco constriction in asthma patients [2]. Air conditioners are destructive to the environment and are responsible for global warming by directly affecting the ozone formation leading to the depletion of ozone layer. It is the major factor for aggravating the chronic obstructive pulmonary disease (COPD) and it also paves the way for many severe acute respiratory syndrome and many other airborne infectious agents [3].Contamination of air conditioner is the major cause for hyperventilation pneumonitis [4]. Which causes many on the allergic reaction as it also increases the indoor air pollutants which leads to elevation of serum IgE which cause mucous membrane irritation and neurological symptoms such as headaches [5][6]. Our team has extensive knowledge and research experience that has translate into high quality publications[7–11].

Usage of air conditioners decrease the efficiency of the lungs which leads to the decreased pulmonary function capacity .Increase inhalation of cold dry hair alters the functional capacity of the lungs which may induce rhinitis[12]. Freon which are used in the cooling systems of the AC are highly toxic .Inhalation of freons in large amount increases the risk of atopic sensation which may lead to repetitive dehydration of small airway when large volumes of cold air is inhaled [13].It is also responsible for the increase indoor air pollutants ,house dust ,mites leading to high eosinophil activity[14].

Now this study is being conducted to compare the lung function of the people who are constantly exposed to an air conditioning work environment and people who are in a non-air-conditioned workplace using a pulmonary function test.

2. MATERIALS AND METHODS

The study was conducted among 20 students of a Saveetha dental college between the age group of 17 to 20 years of both genders with similar anthropometric measurements. Inclusion criteria involves healthy subjects with no history of pulmonary infections. The exclusion criteria involve smokers and those who were under medications and with any cardiological or respiratory disorders were excluded from this study.

The subjects were divided into 2 groups (10 subjects each)

Group 1: AC users
Group 2: Non-AC users

Their medical history and demographic details were collected along with physical examination. The lung functional capacities (i.e) Forced vital capacity (FVC), Forced expiratory volume in one second (FEV1), Peak expiratory flow rate (PEFR), FEV1/FVC ratio and the maximal mid expiratory flow rate [FEF(25-75%)] were compared between the two groups using pulmonary function tests. RMS Helios 702 spirometer was used to assess the pulmonary functional capacity of each individual.

Before the subjects were asked to perform the actual procedure, the procedure was demonstrated before the study participants. The procedure was based on the single breath technique where the participants were asked to forcefully inhale, followed by forceful exhalation into the tube and forceful inhalation from the tube. The subject was asked to repeat the technique three times and three readings were taken and the best reading was taken for calculation. The results were analysed statistically using the SPSS software version 23. The standard deviation and the mean values of all the subjects were calculated. The results were statistically analysed using independent t- test in SPSS version 23.

3. RESULTS

When values of the lung functional capacities were compared , there was a slight decrease in the Forced vital capacity(FVC), Forced expiratory volume in one second (FEV1), FEV1/FVC ratio in AC users compared to non AC users and was not statistically significant ($p<0.05$). The study reported a statistically significant decreased in maximal mid expiratory flow rate [FEF (25-75%)] and PEFR in AC users compared to non AC users ($p<0.05$).

4. DISCUSSION

The respiratory dysfunction observed in AC users is more like an obstructive pattern. In the

present study we found statistical decreases in maximum mid expiratory flour are (i.e) FEF 25-75%. It's a sensitive indicator of small airway disease where most chronic obstructive pulmonary disease starts. A similar study stated that medical students exposed to AC for 6 months increased respiratory symptoms and were more prone for bronco constriction[2,15,16]. Nasal breathing of cold air increases engorgement of venous sinus in the sub mucosa leading to nasal congestion, sneezing and rhinitis.[17][17,18].

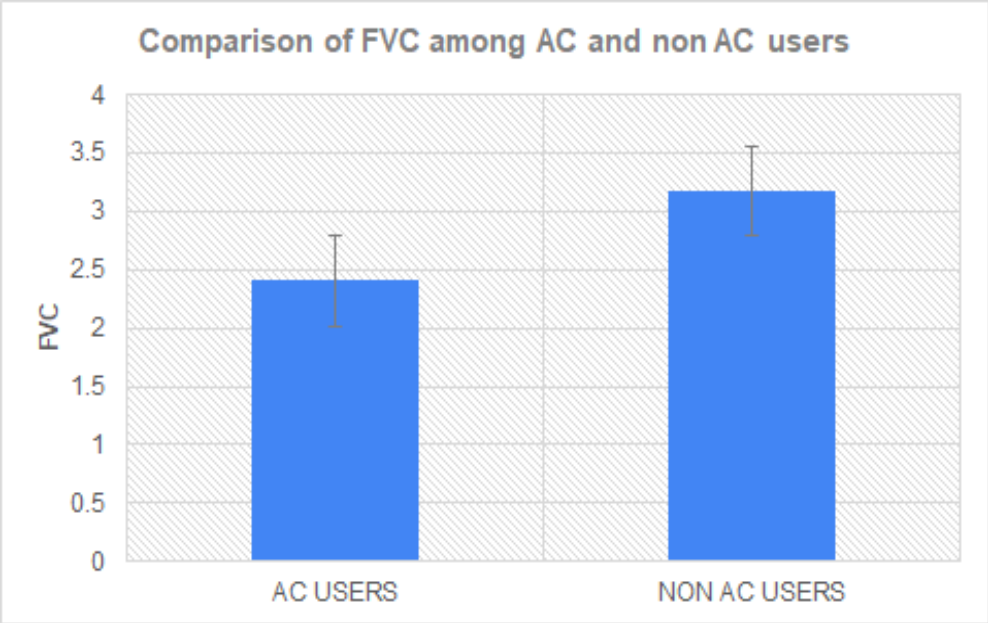

Fig. 1. Represents the bar graph of comparison of FVC among AC and Non AC users; x-axis represents the subjects and y- axis represents FVC in L/sec There was statistical insignificant decrease in the value of FVC in the AC users compared to the Non AC users (p<0.05)

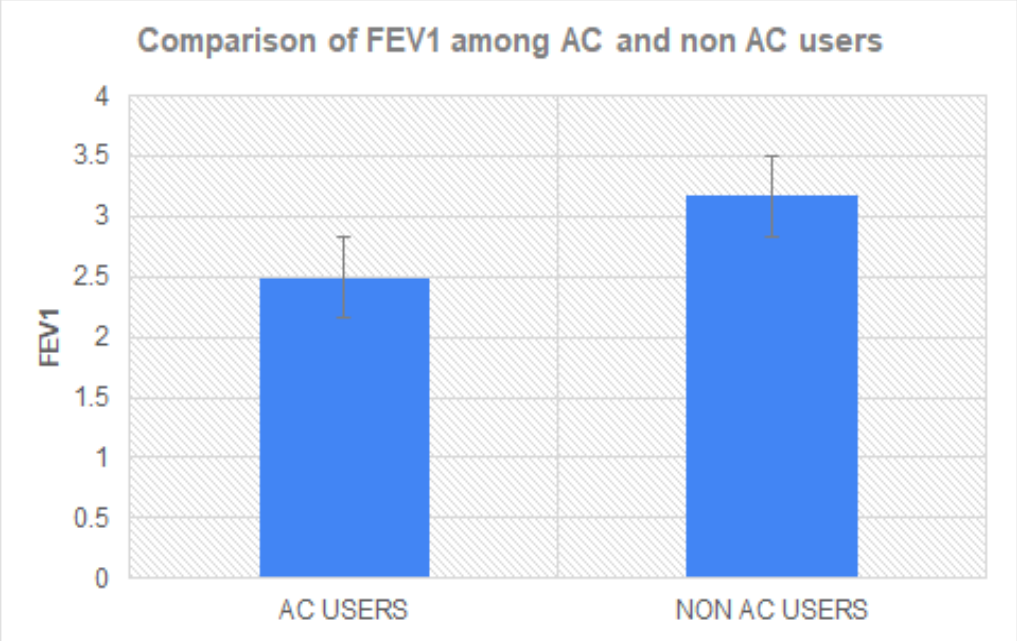

Fig. 2. Represents the bar graph of comparison of FEV1 among AC and Non AC users; x-axis represents the subjects and y- axis represents FEV1 in L/sec There was statistical insignificant decrease in the value of FEV1 in the AC users compared to the Non AC users (p<0.05)

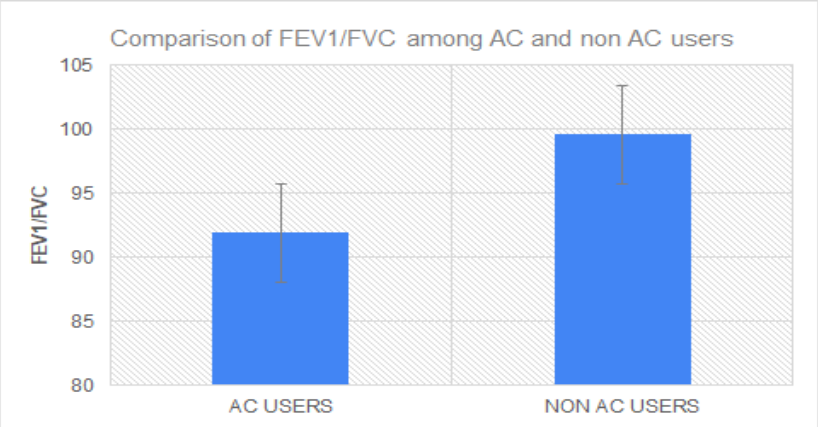

Fig. 3. Represents the bar graph of comparison of FEV1/FVC among AC and Non AC users; x-axis represents the subjects and y- axis represents FEV1/FVC in ratio There was statistical insignificant decrease in the value of FEV1 /FVC in the AC users compared to the Non AC users (p<0.05)

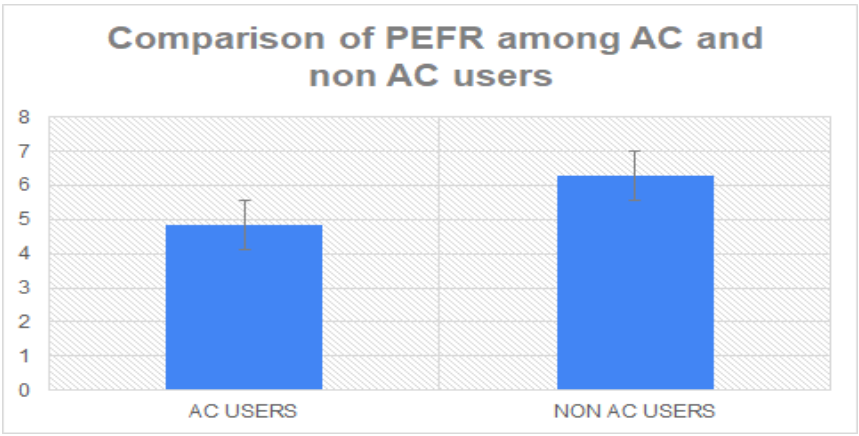

Fig. 4. Represents the bar graph of comparison of PEFR among AC and Non AC users; x-axis represents the subjects and y- axis represents PEFR in L/sec There was statistical significant decrease in the value of PEFR in the AC users compared to the Non AC users (p<0.05)

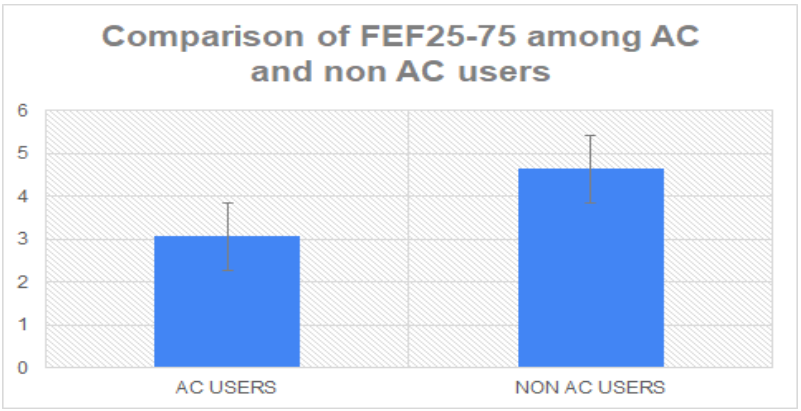

Fig. 5. Represents the bar graph of comparison of FEF (25 - 75) among AC and Non-AC users; x-axis represents the subjects and y- axis represents FEF 25-75 in L/sec There was statistical significant decrease in the value of FEF (25 - 75)in the AC users compared to the Non AC users (p<0.05)

The results of the study showed that peak expiratory flow rate is significantly decreased in the subject exposed to the air condition work environment .PEFR is mainly the caliber of bronchi and bronchioles which are exposed to reflex bronchoconstriction [19,20][21][19,20]. The main reason for bronco constriction in asthma patients is due to hyperventilation of cold air.[22,23][3].

It was also found that when the duration of ventilation is increased there is significant fall in FEV1 .It was found that the level of ventilation plays a major role in bronco constriction than the dryness of cold dry air.[24,25][26,27].

Remodeling of airways like that of asthma patients can be seen in people exposed to repeated cooling of the air leading to desiccation of the airway[28–30].

It was identified that in children who were exposed to AC had mean lower than the other children who are forced and heating and air-conditioning in the study other domestic factors such as heating devices, gas stoves, etc. were considered. The inhalation of cold dry air leads to removal of protective mucosal barriers[31–33]. The study sample is small, and the AC users are not exposed to air conditioners throughout the entire day. Study samples can be increased for more accurate results. Other parameters can also be included such as diet and exercise.

5. CONCLUSION

The present study suggested that regular AC users keep developing ventilatory dysfunction and are at more risk of respiratory dysfunction. The coldness of the aerosol of the AC unit or other factors responsible may be allergens, infections and humidity levels. The sample size determined in the study was less and so further studies on more sample size can substantiate the clear pathology produced by use of air conditioners. Thus technical and hygienic features of air intake must be ensured to maintain a good indoor air quality.[GV1] [V2].

CONSENT AND ETHICAL APPROVAL

The Study was performed after clearance from the Institutional Human Ethical committee and no invasive procedures were used & Informed consent was obtained from the subjects.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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