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Effect of Air Conditioner on Pulmonary Function among Bank Employees at Kannur District - A Cross-Sectional Study

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Abstract: ***Aim: A significant component of modern lifestyle is the use of air conditioner, which has caused increased inhalation of cold dry air. Bank employees are the working community that is exposed to air-conditioner on a greater scale. So, the aim of this study is to determine the effect of air-conditioner on pulmonary function among bank employees at Kannur District. Objectives: To find out the effect of air- conditioner on pulmonary function among bank employees at Kannur district. Methodology: The study included 60 bank employees exposed to air conditioner (Group-A) and 60 bank employees not exposed to air conditioner. The pulmonary function test was carried out for each subject by using a computerized spirometry built in computer program, using the standard laboratory methods. The pulmonary functions including Functional Vital Capacity (FVC), Functional Expiratory Volume in one second (FEV1) and Peak Expiratory Flow Rate (PEFR) were recorded. Result and Discussion: The results showed statistically significant difference between the study groups. There is a decrease in forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV1) and Peak expiratory flow rate (PEFR) in air conditioner users (Group-A) than non-air conditioner users (Group B). Conclusion: In this study, results show significant decline in FVC, FEV1 and PEFR in air conditioner users. Hence, we can conclude that long term exposure to cool dry air of AC affects respiratory system and reduces the pulmonary functions which in turn decrease the lung volumes.***

Keywords: Air-conditioner, pulmonary function tests, FVC, FEV1, PEFR

1. Introduction

Aims

In today's lifestyle with raised living standards air conditioner use is not luxury, but it's a necessity[1]. Industrialization and development of IT companies made migration and modern styles of living in urban areas[2].

Air conditioners are used in various fields such as hospitals, colleges, offices and information technology institutions, cinema theaters, vehicles, railways, buses and banks[3]. Banking industry is the most important constituent of the financial sector of any economy[4]. The Indian banking sector consists of 26 public sector banks, 20 private sector banks and 43 foreign banks along with 61 regional rural banks (RRBs) and greater than 90,000 credit cooperatives at national level[5].

Air conditioners are devices/systems that are used indoors to cool air by reducing the humidity of the air following condensation of the water vapour[6]. The global stock of air conditioners in buildings will grow 5.6 billion by 2050, up to 1.6 billion today-which amounts to 10 new ACs sold every second for the next 30 years, according to the report[7]. Air conditioner users have complaints of irritation in nasal mucosa, difficulty in breathing, skin irritation, headache and fatigue[6].

Spirometry means "the measuring of breath" is routinely used pulmonary function test that measures the volume and speed of air that a person can inhale and exhale[8]. Pulmonary function tests are valuable non-invasive investigation[9].

The Functional Vital Capacity (FVC), Functional Expiratory Volume in one second (FEV1) and Peak Expiratory Flow Rate (PEFR) are the most widely used parameters to measure the mechanical properties of lungs, large and medium sized airways. If FEV1, FVC and PEFR are below the predicted range, the diagnostic possibilities include airway obstruction, restrictive effects[10].

The aim of this study is to compare the pulmonary functions in air conditioner users and non-air conditioner users.

Objectives

- To find out the effect of Air conditioner on pulmonary function among bank employees at Kannur district.
- To find out the effect of non-Air conditioner on pulmonary function among bank employees at Kannur district.
- To compare the effect of Air conditioner and non- Air conditioner on pulmonary function among bank employees at Kannur district.

Hypothesis

Null Hypothesis (H0)

There is no significant effect of air conditioner on pulmonary function among Bank employees at Kannur District.

Alternate Hypothesis (H1)

There is significant effect of air conditioner on pulmonary function among Bank employees at Kannur District.

2. Methodology

Research Question: Is there any effect of air conditioner on pulmonary function among Bank employees at Kannur District?
Study Design: Cross sectional study
Study Setting: Air conditioned and non-air-conditioned banks in Kannur district.
Sampling: Sample size: 120 subjects
Study duration: 2 months

Inclusion criteria:

- Age limit between 28-40 years.
- Both males and females.
- Exposure to AC for at least 6 hours a day for a minimum of 1 year.

Exclusion criteria:

- Smokers.
- History of acute/chronic respiratory diseases.
- History of cardiac diseases.
- Systemic illness which directly or indirectly effects the respiratory system.
- On chronic medications like bronchoconstriction drugs
- Bronchodilator drugs like beta-agonist
- History of Allergy
- Subjects doing regular exercises.
- Subjects doing Pranayama.
- Subjects using Air-conditioner at home
- Subjects tested positive for Covid-19.
- Low socio-economic status
- Pregnancy
- Malignancy

Sampling procedure:

- Sample Design:

Purposive sampling technique

- Study Procedure

From a large number of subjects, 120 subjects with informed consents were selected by proper screening and fulfilling the inclusive and exclusive criteria and they were divided into two groups; Group-A (AC users) and Group-B (Non-AC users) respectively. Each group comprised of 60 subjects each. Measurements including age, height and weight were recorded.

The pulmonary function test was carried out by using a computerized spirometry built in computer program, using the standard laboratory methods. The pulmonary functions including Functional Vital Capacity (FVC), Functional Expiratory Volume in one second (FEV1) and Peak Expiratory Flow Rate (PEFR) were recorded. The best of three readings was recorded and data was analyzed by using standard mean deviation and t-test respectively.

Materials Required

Computerized spirometer, bacterial-viral filter, nose clip, chair, table, weighing machine, stadiometer, pen, paper

Methods Including

Method of data collection: Interview method
Outcome measurement: FVC, FEV1, PEFR

Plan Of Data Analysis

t-test

3. Result

In this study, total 120 subjects were included after considering the inclusion and exclusion criteria and were made into two groups containing 60 members each; Group A consist of bank employees exposed to air conditioner and Group B consist of bank employees not exposed to air conditioner. Data are represented as Mean ± SD and p value < 0.001 is significant. The base line characteristics like age, height, weight of the study subjects was analyzed by 't' test and are not found to be significant between Group A (AC users) and Group B (non-AC users). The pulmonary function tests (FVC, FEV1 and PEFR) were conducted on both groups. Forced vital capacity (FVC), the mean value for FVC in Group-A is 1.94 and 3.10 in Group B respectively with a difference in mean by 1.16, which is statistically significant ($p<0.001$).Forced expiratory volume (FEV1), the mean value for FEV1 in Group A is 1.46 and 2.62 in Group B respectively with a difference in mean by 1.61, which is statistically significant ($p<0.001$).Peak expiratory flow rate (PEFR), the mean value for PEFR in Group A is 3.43 and the mean value for PEFR in Group B is 5.96 with a difference in mean by 2.53, which is statistically significant ($p<0.001$). Hence, Group A (AC users) has reduced FVC, FEV1 and PEFR values in comparison to Group B. Thus, the result rejects null hypothesis.

4. Discussion

The study is to find out the effect of air conditioner on pulmonary function among bank employees at Kannur district. The result of current study reveals that the pulmonary function test values are greater in non-air conditioner users (Group B) as compared to air conditioner users (Group A). The study showed significant decline in FVC, FEV1 and PEFR values in Group A (AC users).

The results of the study showed that air conditioner users are predisposed to respiratory dysfunction[11]. The level of ventilation more than the dryness of temperature of the inspired air is reported to be the principal determinant of the magnitude of bronchoconstriction induced by cold air[11].

Due to cold air inhalation airway becomes hyper responsive[12].Bronchoconstriction occurs and it increases resistance of airways. This makes person susceptible to COPD[13].The mechanism causing bronchoconstriction is vagal mediated nervous reflex[14]. The other factor behind it is increase in the number of mast cells. They release histamine which is a known bronchoconstrictor[15].Cold air also causes epithelial desquamation and loss of epithelial derived relaxation factor which leads to bronchoconstriction[16]. Repeated cooling and desiccation again cause airway remodeling same as that of asthma[17].

The result of the study showed the predisposition of AC users toward respiratory dysfunction; also, the respiratory symptoms was higher among AC users. FVC provides useful information about the strength of respiratory muscle[18]. The pulmonary function (FVC) test value is critically important in the diagnosis of obstructive and restrictive diseases[9]. FEV1 is much more sensitive index for severity of obstructive lung disease[19].PEFR is useful measure to see if the treatment is improving obstructive diseases like bronchoconstriction secondary to asthma[9].

Thus, respiratory dysfunction observed in the AC users is more like obstructive pattern[20]. Our respiratory system has inherent reserve capacity due to which symptoms of a disease appear only after considerable pathological changes have occurred[21].

Nasal cold air provocation causes mast cell activation and sensory nerve stimulation[15]. Histamine released by mast cell causes bronchospasm, increases airway resistance and decreases dynamic compliance[12]. Respiratory tract of the subject exposed to air-conditioned environment is hyper responsive and the patency of the airways is decreased[61].

The result of our study is in harmony with those of Khaliq et at[2] who had done a study in the medical students exposed to air condition for 6 months.

The major limitation of the study is that, it was conducted in a small sample size. Based on the results of statistical analysis, it suggests that in future study should be modified to accommodate the following changes to establish the efficacy of the result a large sample is required for more valid results. Besides more parameters can be assessed. This will further show us how the quality of air we breathe during air conditioning affect our respiratory functions.

The air conditioner does more to our environment than just lowering the temperature. It has a profound effect on the quality of air we breathe and on our respiratory system than just lowering the temperature. Thus, to conclude, air condition users are more at risk of respiratory dysfunction.

5. Conclusion

The aim of the study was to find out the effect of air conditioner on pulmonary function among Bank employees at Kannur District. There is a significant decline in FVC, FEV1 and PEFR values in Group A (AC users) when compared to Group B (non-AC users). Hence, concluded that long time exposure to cold dry air of AC affects respiratory system and reduces the pulmonary functions which in turn decreases the lung volumes.

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