



Evaluation of Lung Functional Status among People Living in Different Type of Housing in Chennai City

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Authors' contributions

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

Article Information

DOI: 10.9734/JPRI/2021/v33i47B33192

Editor(s):

(1) Dr. Ana Cláudia Coelho, University of Trás-os-Montes and Alto Douro, Portugal.

Reviewers:

(1) Abdul Momin Rizwan Ahmad, National University of Medical Sciences, Pakistan.

(2) Patel Mona Rajendrakumar, Gujarat Technological University, India.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/74451>

Received 04 August 2021

Accepted 08 October 2021

Published 05 November 2021

Original Research Article

ABSTRACT

Background: Different housing has its influence on the health of the residents. The high rise apartment is a type of living adapted by people in urban areas of India. It becomes inevitable and poses much convenience and economy without occupying much land area. It is known that the floor of residence is related to the pulmonary function of the individuals.

Objective: The aim of the present study was to comparatively evaluate the lung functional status among the people living in high rise apartments and individual houses in Chennai city.

Materials and Methods: The study included 20 healthy individuals, 10 residents from Individual houses and 10 residents from high rise apartments from the 10th to 15th floor. The lung function was measured using RMS Helios 702 spirometer. They were assessed for a lung function test using RMS Helios 702 spirometer. The parameters such as FVC, FEV1, FEV1/FVC, PEFR, FEF25-75 were assessed, and the statistical test used was independent t test.

Results: The mean of FVC, FEV1, FEV1/FVC ratio, FEF 25-75, PEFR were maximum in high rise apartment residents compared to individual house residents. Statistically significant change was observed in the FEF25-75 value among the two groups.

Conclusion: The study concluded an innovative finding that subjects living in high rise apartments showed innovation in finding better lung functions and this may be attributed to the pollution free zone in high floors.

Keywords: High rise apartment; pulmonary function test; innovative finding; spirometry.

1. INTRODUCTION

Every living habitat influences the health and psychosocial well being of the residents. Housing is an important factor of health as it plays a key role in the development of the respiratory system [1]. Hence, poor housing conditions can lead to various respiratory infections, asthma, lead poisoning etc [2]. With increasing urbanisation, the construction of high rise apartments and other independent houses are rapid [3].

Individual house residents in the urban areas are hugely affected by vehicular pollution [4]. Similarly, high rise apartment residents face a lot of disadvantages such as being isolated socially, fear of crime et [5]. This leads to mental health issues like depression and stress [6][7]. Biologically, people living in high rise apartments are typically in high altitude where the oxygen level is less than that in the ground level [8]. This could affect their blood pressure [9]. Apart from these disadvantages, high rise apartment residents have a lot of health benefits such as better respiratory health [10]. It is reported that higher the floor of residence, the lower the risk of cardiovascular diseases [11][12].

Some of the perceived benefits of high rise buildings are unobstructed scenery, clean air, less noise, privacy and light [13]. Previous studies reported that high rise buildings have a positive effect on the natural systems [14] and a negative effect on the psychology of the residents[15]. Our team has extensive knowledge and research experience that has translate into high quality publications [16–20].

Pulmonary function test is an important tool of diagnosis used in epidemiology [21] and clinical evaluation of various respiratory diseases [22]. This pulmonary function test helps in the monitoring and rehabilitation of lung function [23] and contributes to the long term activity of daily life in stroke patients [24].

Spirometry measures the lung capacity which is an important indicator of physical health and fitness [25]. It also follows up the respiratory complications such as decreased ventilation that

increases the risk of pulmonary disease in stroke patients [26][27]. This ultimately decreases the pulmonary function in them [24]. The aim of the present study is to evaluate and compare the lung functional status of the people living in high rise apartments and individual houses in Chennai city and create awareness on the change in lung function in different houses.

2. MATERIALS AND METHODS

The study was conducted in the department of physiology in Saveetha Dental College, Chennai among 20 normal healthy adults living in independent houses and high rise apartments from the 10th to 15th floor belonging to the age group 17-21 years with matching anthropometric measurements.

2.1 Exclusion Criteria

Subjects with obesity, asthma and cardiorespiratory problems, those who smoke, consume tobacco and those who were on medication for various reasons were not included in the study.

2.2 Method

The subjects were evaluated for medical history and their physical conditions. The functional status of the system was assessed by pulmonary function test using RMS Helios 702 spirometer. Prior to the actual procedure, the subjects were trained to do PFT in a proper way. After a full inspiration, the subjects in standing position blew as forcefully as possible in the mouthpiece and similarly forcefully inhaled back. The readings were recorded. The parameters studied were Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV1), FEV1/FVC ratio, FEV3/FVC ratio, Forced Expiratory Flow 25-75 (FEF 25-75) and Peak Expiratory Flow Rate (PEFR). The data was statistically analysed using SPSS software (version 23). The mean values and standard deviation of the mean were calculated for all the subjects. The statistical test used was independent t test. For significance level, a p value < 0.05 is considered as statistically significant.

3. RESULTS

3.1 Overall Comparison

All the subjects of the present study were with normal height and weight for the age group 17-21 years and none of them were obese (Table - 1).

Statistical analysis of FVC, FEV1, FEV1/FVC, FEF25-75 and PEFR showed high mean values among high rise apartment residents when compared to the independent house residents. (Table -2) (Graph 1-5).

4. DISCUSSION

The results of the present study was highly informative and it helps in understanding the

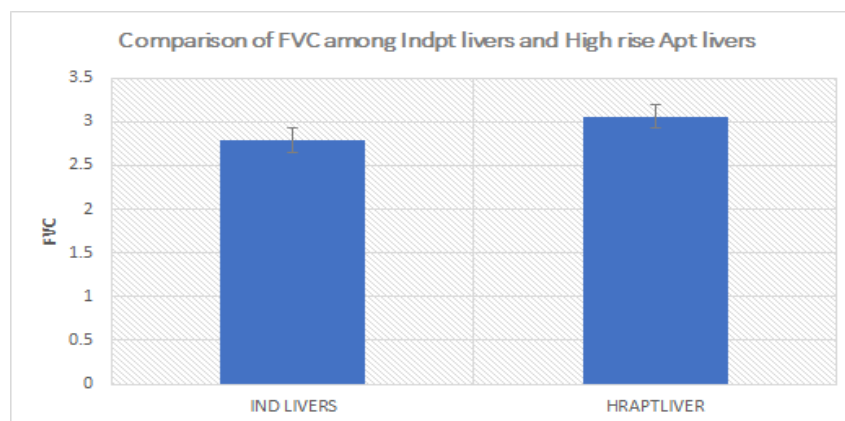
influence of different housing on the respiratory function among normal individuals. From the pulmonary function test we infer that the values of FVC,FEV1, FEV1/FVC ratio, FEF25-75 and PEFR showed an increase among the people residing in high rise apartments than the independent house residents [28] because of the calm and peaceful environment with less pollution and high altitude of apartments [29]. This is in accordance with the previous findings given by [30,31] where the values of FVC, FEV1 were higher among students in high altitude than the students in lower altitude. In accordance with our studies, several reports suggest that an important factor for the respiratory health of high rise apartment residents is the air quality of the atmosphere [32][31].

Table 1. Demographic characteristics of studied subjects

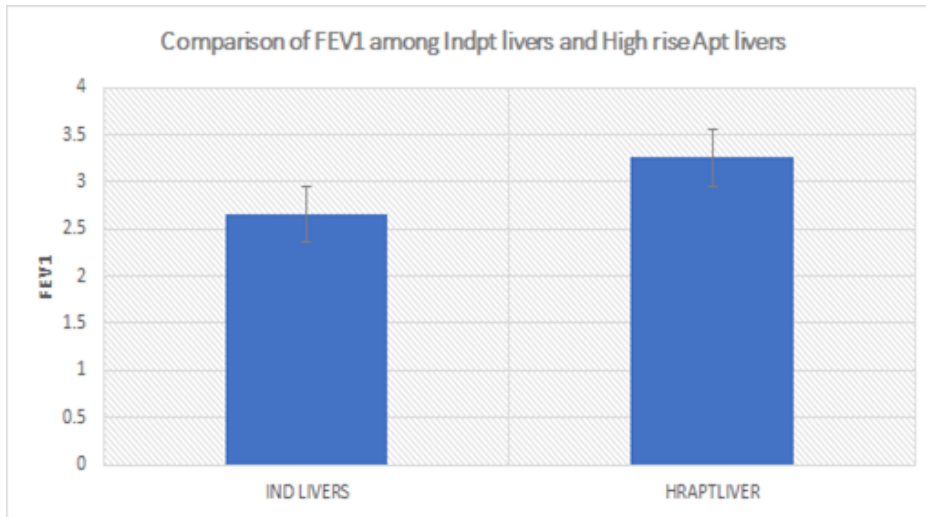
Variable	Mean ± SD Independent house residents	Mean ± SD High rise apartment residents
Age in years	18.6 ± 0.7	18.7 ± 1.16
Height in cm	168.7 ± 8.28	166.4 ± 16.53
Weight in kg	68.8 ± 7.814	60.8 ± 12.35

Table 2. Mean spirometric values between independent house residents and high rise apartment residents

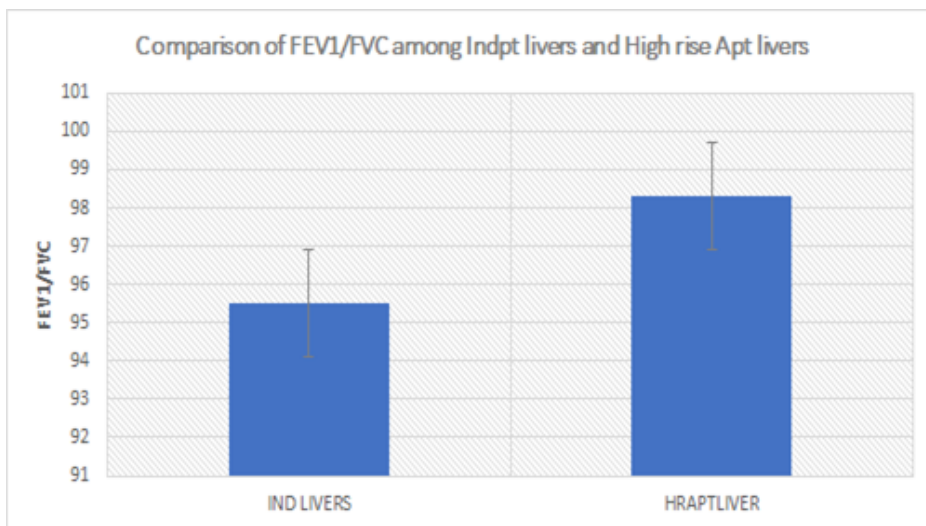
Variable	Mean ± SD Independent house residents	Mean ± SD High rise apartment residents
FVC	2.78 ± 0.513	3.03 ± 0.63
FEV1	2.66 ± 0.556	3 ± 0.506
FEV1/FVC	95.50 ± 9.195	98.31 ± 1.873
FEF 25-75	3.59 ± 1.386	3.89 ± 0.360
PEFR	5.04 ± 1.356	5.32 ± 0.711



Graph 1. Bar graph depicts the association between FVC and the people residing in different types of housing. X axis represents the residents of the two types of housing and the y axis represents the value of FVC. An increase in the value of FVC among high rise apartment residents when compared to independent house residents was observed. But, the value was not statistically significant ($p>0.05$) as in independent t test



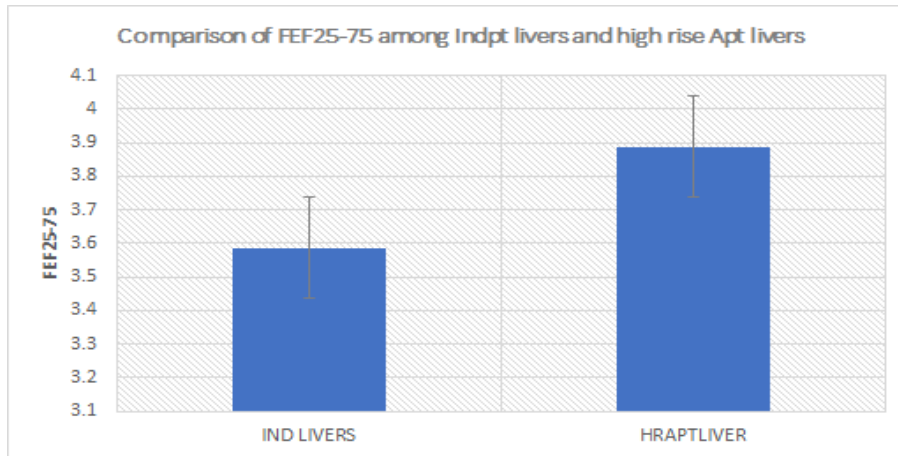
Graph 2. Bar graph depicts the association between FEV1 and the people residing in different types of housing. X axis represents the residents of the two types of housing and the y axis represents the value of FEV1. An increase in the value of FEV1 among high rise apartment residents when compared to independent house residents was observed. But, the value was not statistically significant ($p>0.05$) as in independent t test



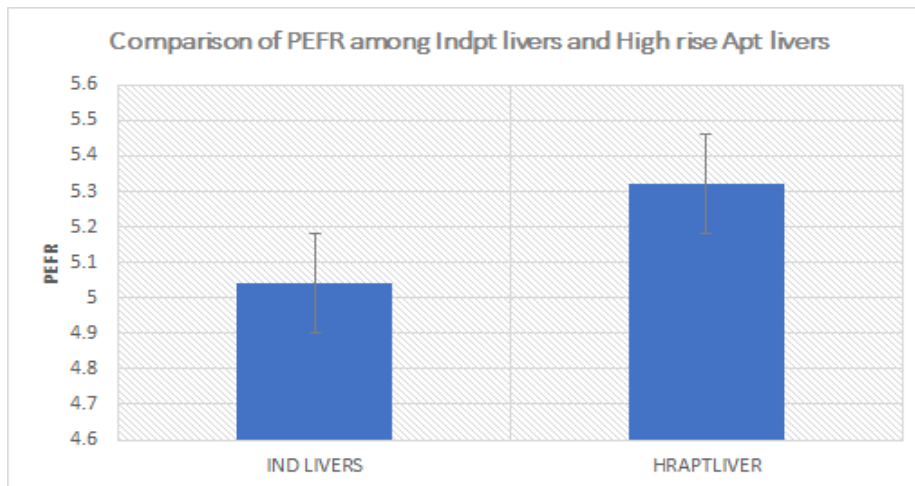
Graph 3. Bar graph depicts the association between FEV1/FVC and the people residing in different types of housing. X axis represents the residents of the two types of housing and the y axis represents the value of FEV1/FVC. An increase in the value of FEV1/FVC among high rise apartment residents when compared to independent house residents was observed. But, the value was not statistically significant ($p>0.05$) as in independent t test

Residents living in independent houses in highly populated areas and lower floors are generally more exposed to high levels of exhaust from vehicle pollution, parking garages and street-level traffic[33] (website). In contradiction to the present study, the findings of [34] reported a decrease in FVC, FEV1 values as the altitude increases. Similarly, the findings of [35] reported that the value of PEFR was the same between

the laborers who were exposed and not exposed to pollution contradicts the results of the present study. It was also found that the reduction in FVC is independently associated with being overweight [36]. Previous reports found that mortality from cardiovascular and respiratory diseases declined considerably the higher one's floor of residence [32,37].



Graph 4. Bar graph depicts the association between FEF25-75 and the people residing in different types of housing. X axis represents the residents of the two types of housing and the y axis represents the value of FEF25-75. An increase in the value of FEF25-75 among high rise apartment residents when compared to independent house residents was observed and the value was statistically significant ($p < 0.05$) as in independent t test



Graph 5. Bar graph depicts the association between PEFR and the people residing in different types of housing. X axis represents the residents of the two types of housing and the Y axis represents the value of PEFR. An increase in the value of PEFR among high rise apartment residents when compared to independent house residents; But, the value was not statistically significant ($p > 0.05$) as in the independent t test

These changes in respiratory functions of the residents at a higher floor level may be due to various factors like the amount of ventilation, the degree of humidity and light exposure [38]. People in lower floor levels are more exposed to inflammatory factors such as bacteria and viruses [39][3]. Thus, new research enlightens the fact that living in high rise apartments increases life expectancy [40]. The major limitation of the present study was the smaller sample size. A similar research can be conducted in future with larger sample size and

the lung functional status can be evaluated among different groups of people.

5. CONCLUSION

The value of FVC, FEV1, FEV1/FVC, FEF 25-75 and PEFR showed an increase among the people residing in high rise apartments than in independent houses. Thus, it can be concluded that living in a high rise apartment develops better lung functions due to the pollution free environment that reduces the risk of bacterial infections and respiratory illness.

ACKNOWLEDGEMENT

The authors would like to thank the study participants for their participation for their kind cooperation throughout the study.

FUNDING

Organisation name from which the student received funding. Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Science, Saveetha University.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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