COMPARATIVE STUDY ON PEAK EXPIRATORY FLOW RATE AMONG HEALTHY SCHOOL GOING CHILDREN BETWEEN AGE 5-12 YEARS IN HILLY AND NON-HILLY AREAS.

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Introduction

When forced expiration begins Within around 100–120 milliseconds, the main airways start to release the effort-dependent measure known as the peak expiratory flow rate (PEFR).. It stays there for 10 milliseconds [1]. Regional variations in lung function in India are well-documented in the literature to be related to a variety of geographic, climatic, anthropometric, dietary, and socioeconomic variables [2].

Millions of people worldwide live permanently at high altitude, where they are subject to a variety of adverse environmental factors like hypoxia, cold, intense sunlight, and rough terrain. As a result, there are noticeable biological differences between human populations living at high and low altitudes, including anthropometric and respiratory variations. [3] Numerous acute and chronic airway systems that work to maximize the oxygen supply are triggered at high elevations[4] .Numerous studies have decisively demonstrated the impact of height, age, weight, and other anthropometric variables including gender on lung function in young, healthy children. [5-8]

However, there are very few research that have sought to look into how altitude affects lung function. The influence of altitude on pulmonary function has not been conclusively even though several research have attempted to compare the PEFR values of Hilly and non-hilly populations. This is as a result of the contradictory findings these investigations produced. The aim of this study was to investigate the effects of altitude on human lung function and to evaluate the PEFR

scores of healthy school going children in these two contrasting geographical areas.

Materials and Methods

During the school year of 2020–2021, 278 students, ages 5–12Years, attending high schools in Salem (altitude 289 metres) and Yercaud (1623 metres) participated in the study. The study received approval from the institute's ethical committee and adhered to the Helsinki declaration. After fully describing the study's goal to all of the children's parents and guardians, prior authorization from the school administration was acquired.

Following a comprehensive clinical examination, a detailed history was taken in accordance with the most recent American Thoracic Society recommendations[9]. Unless they have a history of heart or respiratory problems, wheezing, evident bony or muscular abnormalities of the chest wall, a history of taking asthma medications, a history of frequent hospitalizations or respiratory infections within three weeks of the study, a family history of asthma, etc., all available healthy children were included in the study.

Age was determined for each subject to the closest full year. On a typical calibrated bathroom scale, weight was recorded in kilogrammes while the subject was dressed comfortably and without shoes. A common portable stadiometer was used to measure height (in cm).

The Mini Wright Peak Flow metre was then used to measure PEFR while standing (Clement Clarke International Limited, U.K.).Prior to the recording, the manoeuvre was described and shown to them. Each child was instructed to inhale deeply before blowing as forcefully and quickly as they could into the peak flow metre. After each measurement, the marker was reset to zero. Every child received two practise runs, with each time being prompted to blow harder. The highest reading out of three measurements was noted . The lips and the mouthpiece were kept in a tight seal. Each child received a single-use mouthpiece. .[10]

Statistical analysis

PEFR values made up the data, which was then processed for mean and standard deviation. The dependent variable was the PEFR value, while the independent variables were age, height, and weight. Various groups' PEFR levels were compared using Student's unpaired T-test. P 0.001 was regarded as statistically extremely significant, while P 0.05 was regarded as statistically significant. SPSS version 13.0 was used for the statistical analysis.

Results

Children from Hilly and non-hillys were separated. Table 1 compares the mean and standard deviation for age, height, and weight for children from hilly and non hilly area of both sexes. This table clearly shows that Between Hilly and non-hillys, of both sexes, there is no statistically significant difference. In the values of the parameters in any of the two age groups, indicating a similarity between the two.

Table 1 compares the mean and standard deviation of age and anthropometric measurements across different age groups for male and female children.

Table 1Comparing the mean and standard deviation of age and anthropometric measurements across different age groups for male and female children

Age (in years)	Parameter	Males mean±SD			Females mean±SD		
		Hilly (*n*=84)*	Non hilly (*n*=71)*	*P* value	Hilly (*n*=63)*	Non-hillys (*n*=60)*	*P* value
5 TO 12 YEARS	Age (yrs)	8.14±1.12	8.34±1.03	0.97	8.03±1.00	8.38±1.05	0.89
	Ht (cm)	123.97±11.72	123.66±10.85	0.85	119.94±13.82	121.01±12.74	0.65
	Wt (kg)	20.67±5.59	20.52±4.36	0.89	19.87±7.27	18.99±5.05	0.68

No significant differences exist between the various age groups for either men or women (*n=number of subjects).

As indicated in Table 2, a comparison of mean PEFR values by gender was also conducted separately for Hilly and non-hillys. Male and female Hilly and non-hillys do not differ significantly from one another.

Table 2 PEFR mean and standard deviation values for males and females from hilly and non hilly

Age	Hilly			Non-hillys		
(in years)	Males	Females	*P* value	Males	Females	*P* value
5 -7	162.38±33.16	154.77±16.437	0.062	152.14±20.158	144.21±14.932	0.151
8-10	245.33±22.242	240.66±20.735	0.798	224.39±21.130	223.03±22.006	0.798
11-12	292.73±14.206	287.27±14.09	0.390	272.00±14.757	268.75±17.269	0.672

PEFR: Peak expiratory flow rate ,To find the significant difference, a student's unpaired T-test was used.

When the mean PEFR values of Hilly and non-hilly children aged 5 to 12 were compared overall, it was evident from Table 3 that there was a statistically significant difference between Mean PEFRs of Hilly and non-hilly men, as well as Hilly and non-hilly women, were calculated.

Table 3Comparing PEFR scores for children aged 5 to 12 who live in hilly and non-hilly areas based on mean± standard deviation

	Males			**Females**		
	Hilly	**Non-hillys**	***P* value**	**Hilly**	**Non-hillys**	***P* value**
PEFR (L/min)	**224.52±50.335**	**204.92±47.92**	**<0.001**	**222.56±46.61**	**201.97±48.05**	**<0.001**

PEFR: Peak expiratory flow rate ,To find the significant difference, a student's unpaired T-test was used.

In addition, when mean PEFR values were compared across age groups [Table 4], it was discovered that there was a statistically significant difference between mean PEFR of Hilly and non-hilly males in the 5 to 7 year age group, as well as a statistically significant difference between Hilly and non-hilly males in the 8 to 10 year and 11 to 12 year age groups. Additionally, while the difference in mean PEFR values between highland and lowland girls aged 5 to 7 years was statistically significant, the difference between highland and lowland females aged 8 to 10 and 11 to 12 years was also statistically significant ,Tables 3 and 4 so clearly demonstrate that residents at high altitudes have improved lung function scores.

Table 4: Comparison of PEFR mean±standard deviation values by age group between hilly and non-hilly

Age	Males			Females		
(years)	Hilly	Non-hillys	*P* value	Hilly	Non-hillys	*P* value
5-7	162.38±33.16	152.14±20.158	<0.001	154.77±16.437	144.21±14.932	<0.001
8-10	245.33±22.242	224.39±21.130	<0.001	240.66±20.735	223.03±22.006	<0.001
11-12	292.73±14.206	272.00±14.757	<0.001	287.27±14.09	268.75±17.269	<0.001

Student's unpaired *T*-test was performed to see the significant difference, PEFR: Peak expiratory flow rate

Discussion

The current study compared the PEFR values of healthy schoolchildren from Hilly and non-hillys in order to determine the impact of altitude on PEFR. In our study, native high-altitude children had considerably higher PEFR readings than their lowland counterparts. Similar findings to those of the current study have been reported by numerous other writers worldwide. [12-15]

According to Qazi et al. [16], residents at higher altitudes have much more developed auxiliary muscles of respiration because of hypoxia, which may explain why altitudes greater than 1500 metres appear to produce significant changes in lung volumes and flow rates. Furthermore, residents of high-altitude areas may have higher lung volumes and flow rates due to higher anthropometric ratios, such as a higher vertical chest size, a higher chest to leg ratio, or superior lung development brought on by a higher degree of physical activity, a smaller population, and minimal environmental pollution. These elements may also contribute to the increased lung volumes and flow rates observed in these populations.

According to Weitz et al[17] .'s theory, creating a hypoxic atmosphere is more likely to result in improved lung function at higher elevations than increasing exercise or reducing pollutants.

According to Dr. West[18]Maximum expiratory and inspiratory fluxes exceed those at sea level , because higher elevations have less dense air, which results in less airway resistance.

Some publications claim that the PEFR values of Hilly and non-hillys do not significantly differ, in contrast to the current study.

Young adults from Nepal were assessed for their PEFR levels and contrasted with those from India by Debray et al. [19} It was discovered that adult Nepalese PEFR may be predicted using prediction equations created for Indian adults. because there was no discernible difference between the mean and Male Nepalese with Standard deviation PEFR of 485.7 49.85 L/min and male or female Indians with Standard deviation PEFR of 490.4 49.85 L/min or 365.2 55.83 L/min. PEFR values of healthy hilly tribal children and non hilly North Indian urban children were examined by Kashyap et al.[20] They found that the mean PEFR for boys living in hilly areas was 245.5 74 L/min, which was equal to the mean PEFR for boys living in non-hilly areas (248 64 L/min).

Study limitations

Due to its lower accuracy when compared to computerised spirometers, the use of compact Wright's peak flow metres to measure PEFR values is preferred. On the other hand, rigorous adherence to established guidelines and the use of a readily accessible portable tool ensure maximum precision.

Due to the closure of schools due to the COVID pandemic, we decreased the sample size from 500 to 278; yet, the sample size for our study is still fairly small**.**

Future directions

Future clinical research should evaluate additional lung function markers in high-altitude natives, such as forced vital capacity, forced expiratory volume, and maximal ventilatory volume. Finding out how altitude affects respiratory function will be made much easier by this.

Conclusion

According to the study's findings, those who reside at high altitudes had significantly higher PEFR. The decrease in air density at altitude or even greater lung growth in Hilly as a result of physiological adaptations to hypoxia may be responsible for the increase in PEFR with altitude. As a result, just like other variables like age, height, weight, and gender, altitude plays a significant role in determining lung function.

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