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Original Research Article

Comparison of pulmonary function tests in urban and rural children of Nagpur, Maharashtra, India

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ABSTRACT

Background: Pulmonary function tests (PFT) are considered as an essential component for evaluation of lung functions. PFTs are influenced by various parameters like anthropometric, geographic, ethnic, socio-economic parameters. Anthropological parameters are affected by nutrition and physical activities in young age, which directly affect the lung size and function. The aim of this study was to compare PFTs in urban and rural children of same district and to find out significant difference, if any.
Methods: It was observational study. 150 each healthy children in the age group of 10 to 14 years were selected from urban and rural schools. After recording anthropometric data, PFTs were measured in all the children of both the groups. PFTs were compared among urban and rural children using unpaired t-test.
Results: All the independent variables like age, weight and height were having linear positive correlation with PFTs ($p<0.05$). On comparing PFTs like Forced Expiratory Volume (FEV), Forced Expiratory Volume at the end of one second (FEV1), Percentage of Forced Expiratory Volume (FEV1%) between rural and urban children no statistically significant difference was noted ($p>0.05$)., but Peak Flow Expiratory Flow Rate (PEFR) was significantly more ($p<0.05$) in rural than urban students.
Conclusions: We can conclude that during measurement of PFTs especially PEFR in children, the factor of urban and rural background must be considered in prediction equation.

Keywords: Children, PFT, Rural, Urban

INTRODUCTION

The pulmonary function tests are considered as an essential part for evaluation of lung functions. PFTs are influenced by various factors like anthropometric, geographic, genetic, socioeconomic and life style.[1,2] The development of pulmonary functions and growth of physical parameters i.e. height and weight are coexistent. These physical parameters are further affected by nutrition and physical activities of children.[3]

During examination of pulmonary functions usually the obtained values are compared with the standard values obtained from healthy individuals of same age, sex and anthropometric parameters. Since socioeconomic factor and nutrition also affect the values of PFTs, these reference values must also be standardized by socioeconomic factor. With this background present study is aimed at the comparison of PFTs like FEV, FEV1, FEV1% and PEFR among the children of urban school and rural school of same district.

METHODS

It was observational study. The study was carried out on the school children in the age group of 10 to 14 years.

150 healthy students from urban school of Nagpur city i.e. MKH Sancheti Public School were randomly selected. Out of 150, 77 were boys and 73 were girls. Similarly, 150 healthy students from rural school of Nagpur district i.e. Ashram School were randomly selected. Out of 150, 78 were boys and 72 were girls.

For selection detail history and clinical examination was done. Students with absence of cardio-respiratory diseases, thoracic cage disorder, and allergic illness were included. Daily formal playing was taken into consideration but regular practice of any sport, exercise or yoga was not considered for inclusion.

Children were motivated to participate in the study by explaining the plan of study to them. Recruitment was purely on voluntary basis. Informed consent was taken from the students and their teachers after explaining the study design. The protocol of project was submitted to Institutional Ethical Committee and the project was started after approval. Study was done in the morning hours between 10 am to 12 noon to avoid diurnal variations.

To begin with, all the students were subjected to measurement of anthropometric parameters like weight in kg and height in cm. Age was determined by noting the date of birth from the register of schools. It was followed by measurement of PFTs like FEV, FEV1, FEV1% and PEFR.

Measurement of anthropometric parameters

- Weight: It was measured without shoes with the help of Soehnle's weighing machine to the nearest 0.5 kg mark.
- Standing Height: It was measured against wall inscribed with measuring scale to the nearest centimeter.

Measurement of PFT

Pulmonary function tests were recorded by using computerized spirometer (MIR spirolab). All the students were given the demonstration of tests. They were made familiar with the instrument and the procedure for performing the test. The tests were performed in sitting position. The subject was asked to take full inspiration which was followed by as much rapid and forceful expiration as possible in the mouthpiece with the nostrils closed. Three consecutive readings were taken and the best reading among three was selected and noted. One single expiratory effort gives readings about many parameters. Out of these FEV, FEV1, FEV1% and PEFR were selected.

Demographic parameters and pulmonary function parameters were presented as Mean±SD. Categorical variables were expressed in frequency and percentages. Pulmonary function parameters were compared between rural and urban by performing independent t-test. Pearson's correlation coefficient (r) was calculated to assess the strength and magnitude of correlation between PFT parameters with age, weight and height separately for rural and urban students. $P<0.05$ was considered as statistical significant. Statistical software STATA Version 14.0 was used for statistical analysis.

RESULTS

Urban and Rural groups showed statistical similarities for basic parameters like age, sex, height and weight Table 1. Relationship of FEV, FEV1, FEV1% and PEFR with anthropometric parameters is shown in Table 2.

Comparison of PFTs i.e. FEV, FEV1, FEV1% and PEFR between urban and rural students is shown in Table 3. In present study, as per Table 1 the urban and rural groups of students were statistically similar for basic parameters like age, sex, height and weight. As per Table 2, in urban children except FEV1% a significant positive correlation was observed between FEV, FEV1 and PEFR and all anthropometric parameters.

In rural children, except PEFR a significant positive correlation was observed between FEV, FEV1 and FEV1% and all anthropometric parameters. Table 3 shows the comparison of the PFTs of urban children with rural children. FEV, FEV1 and FEV1% were not significantly different. But PEFR was significantly more in rural children.

Table 1: Baseline characteristics of study subjects.

Parameters		Urban	Rural	p-value (NS)
Age (years)		11.05 ±2.50*	10.72 ±2.49*	0.2094
Sex	Male	88	84	1.000
	Female	90	87	
Height (cm)		138.96 ±13.8*	136.24 ±15.38*	0.0946
Weight (kg)		30.39 ±8.52*	28.83 ±9.52*	0.1073

NS: Not significant, *Mean±SD

DISCUSSION

In present study, the urban and rural groups of students were statistically similar for basic parameters like age, sex, height and weight. In urban children, a significant positive correlation was observed between FEV, FEV1 and PEFR and all anthropometric parameters.[1-10] In urban children, there was no correlation between FEV1% and anthropometric parameters.[11,12] In rural children a significant positive correlation was observed between FEV, FEV1 and FEV1% and all anthropometric parameters.[1-10] In rural children, there was no correlation

between PEFR and anthropometric parameters. On comparing the PFTs of urban children with rural children, FEV, FEV1 and FEV1% were not significantly different. But PEFR was significantly more in rural children. This finding of PEFR was consistent with the findings of JW Carson.[13]

Table 2: Correlation of anthropometric parameters and PFT parameters.

Residence		Age in years		Height in cm		Weight in kg	
		r-value	p-value	r-value	p-value	r-value	p-value
Urban	FEV	0.6748	<0.0001	0.8289	<0.0001	0.8044	<0.0001
	FEV1	0.5603	<0.0001	0.6702	<0.0001	0.6796	<0.0001
	FEV1%	-0.0832	0.2698	-0.1000	0.1842	-0.0427	0.5715
	PEFR	0.5166	<0.0001	0.5397	<0.0001	0.5871	<0.0001
Rural	FEV	0.8411.	<0.0001	0.8695	<0.0001	0.8263	<0.0001
	FEV1	0.8152	<0.0001	0.8427	<0.0001	0.8012	<0.0001
	FEV1%	0.3780	<0.0001	0.4003	<0.0001	0.3409	<0.0001
	PEFR	0.1433	0.0616	0.1322	0.0848	0.0689	0.3703

Table 3: Comparison of FEV, FEV1, FEV1% and PEFR between Urban and rural subjects.

Parameters	Urban	Rural	p-value (NS)
FEV	1.62±0.68	1.50±0.60	0.0746
FEV1	1.25±0.61	1.22±0.61	0.4199
FEV1%	77.50±19.82	78.65±21.10	0.5997
PEFR	1.92 ±0.94	2.67±4.49	0.0288

NS: Not significant, Mean±SD

PEFR is accepted worldwide as objective indicator of ventilator capacity and it represents a caliber of bronchi and large bronchioles undergoing effort dependent reflex constriction.[14,15] The elementary factors upon which PEFR values depend are voluntary efforts, strength of expiratory muscles, generating force of contraction, lung volume, airway size elastic recoil strength of lungs.[7] The possible reason for more PEFR in rural children is that though urban children are adequately and regularly fed, they are restricted to limited sports activities in order to score more marks in examination. On the other hand, in rural children though their feeding is not at par with urban children, they are liberally engaged in sports activities. These sport activities in this age group of children lead to more growth of airway passage including size and increase in strength of expiratory muscles that generates more force of contraction hence there is more PEFR in rural children.

CONCLUSION

From the study, it can conclude that during measurement of PFTs especially PEFR in children, the factor of urban and rural background must be considered in prediction equation. Limitation of study is that it involves small sample size. To decide the role of urban and rural background in PFTs the further studies with large sample size of children in various geographic areas are advised.

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