Research Article

Normative data of peak expiratory flow rate in healthy school children of Ghaziabad city—a pilot study

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Abstract

Background: Age, sex, weight, and height are the main factors that affect peak expiratory flow rate (PEFR). Various authors have shown that geographical, climatic, anthropometric, nutritional, and socioeconomic conditions of India are associated with regional differences in lung function. **Aims and Objective:** To establish the normative data of PEFR among school children aged 10–14 years in Ghaziabad city, Uttar Pradesh, India. **Materials and Methods:** A cross-sectional study was done in 500 school children aged 10–14 years in Ghaziabad city. PEFR was recorded with the Mini-Wright Peak Flow Meter. Anthropometric variables such as age, height, weight, and body mass index were recorded. Results were analyzed by ANOVA with SPSS, version 17.0, using unpaired *t* test. **Result:** Results showed that there was an increase in PEFR in boys and girls with an increase in age, height, and weight. **Conclusion:** Normative data of this study can be useful for the diagnosis, treatment, and follow-up of children with respiratory problems such as asthma of this region.

KEY WORDS: Peak Expiratory Flow Rate; School Children; Normative Data

Introduction

Lung function tests provide a better understanding of functional changes in the lungs and their significance from the view point of diagnosis.[1] Peak expiratory flow rate (PEFR) recording is an essential measure in the management and evaluation of asthmatic children.[2] The Peak Flow Meter is a useful instrument for monitoring PEFR in healthy children, asthmatic children, and adults.[3,4,5,6] Age, sex, weight, and height are the main factors that affect PEFR.[7] Various authors have shown that geographical, climatic, anthropometric, nutritional, and socioeconomic conditions of India are associated with regional differences in lung function.[8]

But, there are not much data available on the normative values of PEFR in school children (8–14 years) of Ghaziabad city. Thus, this study was designed to establish normative data of PEFR in healthy school children of Ghaziabad city and to find the correlation of anthropometric parameters such as age, sex, height, and weight with PEFR.

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Materials and Methods

This cross-sectional study was conducted in Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India. Ethical approval was taken from the research committee of the institution before starting the study.

Three schools were randomly selected within 5 km of Santosh Hospital. Five hundred children of both sexes, in the age group of 10–14 years, were enrolled for the study. The study was conducted over a period of four months from

November 2014 to February 2015. The administrative staffs in the selected schools were contacted and the objectives of the study explained. A letter was sent to every parent explaining the procedure and seeking permission to evaluate the child. All the students were also given a questionnaire, which they were asked to return after getting it filled with reference to history of asthma or any other chronic disease in the family.

Inclusion Criteria:
School going children in the age group of 8–14 years.

Exclusion Criteria:

1. Children younger than 8 years and older than 14 years.
2. Children with acute respiratory infection within 7 days of the study.
3. Children with any other major or chronic illness.
4. History of asthma, allergies, or chest illness.
5. Family history of asthma among first-degree relatives.

Age was taken as completed years in the school records. Height was measured using a standard stadiometer with the subject standing in an erect posture with the heel and back against the wall without footwear. The readings were taken to the nearest 0.1 cm.

Table 1: Mean ± SD of PEFR levels according to age in boys and girls

Age (years)	Boys		Girls		*p*
	n	PEFR (L/min), mean ± SD	*n*	PEFR (L/min), mean ± SD	
8	56	251.1 ± 45.8	62	245.1 ± 44.5	0.4722
9	68	263.2 ± 46.2	75	253.3 ± 43.2	0.1876
10	74	290.9 ± 50.2	68	278.5 ± 52.6	0.1529
11	56	300.5 ± 60.5	50	295.6 ± 66.9	0.6929
12	78	320.5 ± 70.2	68	310.9 ± 68.5	0.4059
13	76	360.7 ± 78.2	81	345.6 ± 77.2	0.2254
14	92	410.2 ± 80.5	96	390.8 ± 50.3	0.0480*

p value > 0.05 was considered nonsignificant.
*Significant difference.

Weight was recorded in kilograms using a calibrated portable weighing machine (Avery) scale, with a capacity of 120 kg and a sensitivity of 0.05 kg. The students were weighed without wearing shoes and with minimal clothes. The body mass index (BMI) was calculated as the ratio of weight in kilograms divided by the square of the height in meters [weight (kg)/height (m^2)].[9] Children with BMI more than or equal to 85th percentile of reference data were considered overweight.[10] The reference data used to identify the cut offs were taken from CDC 2000 data set for BMI.[11]

Peak Expiratory Flow Rate:
A Mini-Wright Peak Flow Meter was used for recording the PEFR values. All the children were tested in a standing position. The instrument was calibrated initially and on all days during the study. Before testing, the procedure was explained and demonstrated to each child until full familiarity was achieved. The mouthpiece was washed and sterilized for each subject.

Each child was told to take a deep breath and then blow into the peak flow meter as hard and fast as possible. Every child was given two trial runs and encouraged to blow harder each time. The child then blew into the Mini-Wright Peak Flow Meter thrice, and the highest reading was accepted as the final PEFR in each case. Measurement of flow rate was carried out by a single observer, so that interobserver variation was eliminated.

Statistical Analysis:
Age, height, and weight were the independent variables, while PEFR value was the dependent variable. Correlation between age, height, weight, and PEFR was carried out using the Pearson's correlation. Results were analyzed by ANOVA with SPSS, version 17.0.

RESULTS

500 school children in the age group of 10–14 years of both genders were evaluated for PEFR. PEFR values increased in linear relation to age in girls as well as well as boys and it was statistically significant ($p < 0.05$) [Table 1]. Results showed that with increase in height, PEFR values increased, and rate of increase was more in boys as compared to girls [Table 2].

Table 2: Mean ± SD of PEFR levels according to height in boys and girls

Height (cm)	Boys		Girls		*p*
	n	PEFR (L/min), mean ± SD	*n*	PEFR (L/min), mean ± SD	
110–119	40	185.5 ± 40.2	37	180.1 ± 30.8	0.5127
120–129	116	221.1 ± 41	126	211.8 ± 40.8	0.0784
130–139	128	255.5 ± 47.4	138	246 ± 43.2	0.0895
140–149	112	278.2 ± 47.7	115	266.8 ± 64.2	0.0049*
150–159	46	320.2 ± 50.2	39	281 ± 50.3	0.1311
160–169	38	380.2 ± 75.1	31	310.1 ± 65.3	0.0032*
>170	20	412.2 ±7 0.3	14	350.5 ± 68.3	0.0169*

p value > 0.05 was considered nonsignificant.
*Significant difference.

Table 3: Mean ± SD of PEFR levels according to weight in boys and girls

Weight (kg)	Boys		Girls		*p*
	n	PEFR (L/min), mean ± SD	*n*	PEFR (L/min), mean ± SD	
10–19	37	178.5 ± 25.2	31	170.2 ± 27.7	0.2043
20–29	182	220.2 ± 50.8	191	205.6 ± 40.3	0.0022*
30–39	97	270.1 ± 52.3	91	250.6 ± 55.4	0.0139*
40–49	113	310.6 ± 60.5	130	290.4 ± 65.3	0.0002*
50–59	53	350.7 ± 78.8	41	320.7 ± 55.5	0.1706
>60	18	380.2 ± 80.6	16	366.2 ± 50.2	0.5536

p value > 0.05 was considered nonsignificant.
*Significant difference.

Table 4: Carl Pearson correlation of PEFR and anthropometric parameters

Pair	Boys			Girls		
	r	*p*	Result	*r*	*p*	Result
PEFR vs. age	0.96	<0.05	Significant	0.97	<0.05	Significant
PEFR vs. height	0.99	<0.05	Significant	0.99	<0.05	Significant
PEFR vs. weight	0.99	<0.05	Significant	0.99	<0.05	Significant

Table 3 shows that PEFR values increased significantly in both the sexes with increase in weight, but the increase was not statistically significant > 49Kgs. Coefficient of correlation obtained for all the three variables was statistically significant ($p<0.05$) [Table 4].

Discussion

Assessment of lung function is very important in respiratory medicine in healthy and diseased subjects. PEFR is an effort-dependent parameter, emerging from the large airways within about 100–120 m/s of the start of forced expiration. It remains at its peak for 10 m/s.[12] PEFR has gained importance for the evaluation of obstructive and restrictive diseases.[13] It is a simple and reliable way of monitoring the severity of asthma and assessing the response to the treatment. It would be more appropriate for each region to have its own value because there are many biological sources of variation in pulmonary function. Intraindividual variation may be because of airway resistance, maximal voluntary effort, and the possible compressive effect of the maneuver on thoracic airways.[14] Interindividual variation may be because of height, weight, age, race, and past and present health. Geographical factors, exposure to environmental and occupational pollutions, and socioeconomic status can also influence intraindividual variation.[15]

Our study was designed to establish normal values of PEFR for healthy children of Ghaziabad so that local reference standards are available when this measurement is used for the assessment of airway obstructive diseases.[16]

Our study showed that values increased in linear relation to age, height, and weight. Similar results were shown by various other authors.[17–20]

PEFR values in our study were higher in boys when compared with girls of the same age. But, our results were not similar to those reported by Singh and Peri[21] and Deshpande et al.[22] They showed that there was not any sex variability in PEFR.

On the other hand, Rahman et al.[23] showed that girls had a higher PEFR than boys of the same age group, which was contrary to our results.

Conclusion

Our study has generated the preliminary reference values for PEFR for the children of Ghaziabad city.

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