Research Article

Study of Peak Expiratory Flow Rate of School Children of South Odisha

Mishra Shubhankar*[1], Behera Asish K[1], Ravichandra K.R[1], Sethy Geetanjali[2], Soren Narendra N[3]
[1]Junior resident, Department of pediatrics, MKCG Medical College, Berhampur, Odisha
[2]Associate professor, Department of pediatrics, MKCG Medical College, Berhampur, Odisha
[3]Professor, Department of pediatrics, MKCG Medical College, Berhampur, Odisha

*Corresponding author
Shubhankar Mishra
Email: dr.subham.scb@gmail.com

Abstract: Respiratory diseases represent the most common cause of death in children. Allergic respiratory disorders in particular asthma are increasing in prevalence. Prevalence of asthma in Indian children is found to be as high as 4.75%. This cross sectional prospective study was conducted to establish normal values of PEFR for children of south odisha. PEFR is a lung function test which is easily measurable and reproducible but baseline value of PEFR has not been studied in Odisha. The aim of this study is to establish normal values of PEFR in normal children of Berhampur(5-14 Years).To find out the correlation of various anthropometric parameters with PEFR. Derive predictive equations correlations PEFR with age, weight and height. A total of 708 normal school going children 5-14 years were selected randomly to obtain PEFR form 3 different schools of Berhampur,(prominent city of south odisha). The miniWright peak flow meter was used to measure peak flow rate in a standard way. The highest of 3 reading was taken as the correct value. Anthropometric parameters including height, weight, age, gender were recorded appropriately and body mass index was calculated. Data were analysed by Microsoft WORD, EXCEL, Graph pad instat. Strong correlation was found between PEFR with height, weight, age, BMI. Correlation of PEFR was best with height, followed by with weight, age and BMI. Though the mean PEFR of boys are more than girls, there was no significant difference in the same, when similar height is taken into consideration. The PEFR value of children of Berhampur was less than that of other parts. This indicates PEFR is variable according to geographical situation, environmental condition, life style of people etc. PEFR (l/min) predicted form height based regression equation was the most consistent finding in a good number of studies including present one. Regression equation calculated taking height as variable is as follows, PEFR for Boys =4.591*Height(cm)-393.03. PEFR for Girls =3.198*Height(cm)-217.92. Our results appear to be reliable due to high correlation coefficient with body parameters and can be used as a normal reference value for normal children of southern odisha for 5-14 years years age group. PEFR correlated best with height, followed by with weight, age, BMI.Though mean PEFR of boys is little more than girls, there is no significant difference of PEFR between boys and girls for same height. PEFR for Boys =4.591*Height(cm)-393.03, PEFR for Girls =3.198*Height(cm)-217.92. The PEFR value of children of Berhampur is less than that of other parts.(From the available data).This implies PEFR varies with geographical situation, environmental condition, life style of population. Results of this study can be used as a standard (PEFR value) for children of 5-14 year age group of southern odisha.
Keywords: PEFR, anthropometry, asthma.

INTRODUCTION

Respiratory diseases represent the most common cause of death in children. In this a large number accounts to be obstructive airway disease. Allergic respiratory disorders in particular asthma are increasing in prevalence, which is a global phenomenon. Even though genetic predisposition is one of the factor in children for increased prevalence, urbanisation, air pollution and environmental tobacco smoke contributes more significantly[1]. Prevalence of asthma in Indian children is found to be as high as 4.75%. Pulmonary function tests of various types are utilized clinically as well as epidemiologically to measure functional status of respiratory system. Though

they do not provide a specific diagnosis, they help us to understand the severity, course and progress of the respiratory diseases[2]. The peak expiratory flow rate (PEFR) measurement is simple, reproducible and reliable way of judging the degree of airway obstruction in various obstructive pulmonary diseases, specially asthma. Peak expiratory flow rate is easily measured by using a mini-Wright's peak flow meter (mWPFM), which is easy to use, reliable and can be recorded even by the patients or by the parents at home[3].

Asthma is the most common chronic inflammatory disease in children and is a major global health problem which exerts a substantial burden on the

family, health care services and on the society as a whole. During the past decade, understanding of asthma self-management has developed greatly, and there is a general agreement that more effective methods of educating patients are needed to reduce morbidity and mortality from the disease. PEFR measurement can reveal the diurnal variability of airway of patient suffering from reactive airway disease but not in normal children; that gives the early clue to have the diagnosis and management. Fall of peak expiratory flow rate in a child with asthma is impending sign of acute asthma. The response to treatment can be monitored by using serial PEFR measurement.

Prediction equation relating PEFR to age, gender, height, weight, body mass index are available for western children, North Indian and South Indian children. As for any parameter used to assess dysfunction, the importance of having regional reference value can not be overlooked. No data is available about PEFR in children in Odisha. This study aims to construct a normal PEFR value in both sexes in the age group of 5-14 years according to height, weight, BMI, in normal children of southern odisha and for comparison with other studies carried out in and out of India.

AIMS AND OBJECTIVES
1. To establish normal values of PEFR in normal children of south odisha(5-14 Years).
2. To find out the correlation of various anthropometric parameters with PEFR.
3. Derive predictive equations correlations PEFR with age, weight and height .

MATERIALS AND METHODS
Study Period- November 2011 to September, 2013

Study Design- prospective cross-sectional study.

Place of Study- The study was carried out in 3 different schools of Berhampur city.
- Medical campus U.P. School, Berhampur
- Govt. High School, Medical College Campus, Berhampur.
- Kendriya Vidyalaya Sangadhan, Ambapua, Berhampur

The study protocol was approved by Institutional Ethical Committee of M.K.C.G. Medical College Hospital, Berhampur.Seven Hundred Eight normal school children of age group 5-14 years were included in the study group form 3 different schools of Berhampur as per inclusion criteria.

Inclusion Criteria
- Normal healthy children : 5-14 yeas age group.
- Both boys and girls

Exclusion Criteria
- Children <5 Years or > 14 years
- Known case of asthma or chronic lung disease
- Smokers
- H/O respiratory illness within week prior to study
- Any other medical illness
- Thoracic deformity

How to use mini-Wright peak flow meter
The purpose and technique of the test should be explained to the subject followed by a demonstration of its performance. Person should perform the test in standing position holding the peak flow meter horizontally without interfering with the movement of the marker (arrow) or covering the slot. He or she should asked to take deep breath then exhale it by forceful expiration as fast as possible after maintaining air tight seal between lip and mouth piece of the instrument. Reading should be taken keeping the instrument horizontal position.

Data Collection Procedure
Considering he age group 5-14 years, healthy students from 3 different schools in Berhampur were included in the study. All the selected students were interviewed before inclusion into the study. Information were taken form class teacher regarding the students of primary class and directly from students of class-IV and above. Students who fulfilled the inclusion criteria were separated, proper history taken and clinical examination was conducted to rule out any medical illness.

One with low range (50-350 L/min) other with high range (60-800 l/min). High range model was used when values >350 h/min were found. before asking to perform PEFR, 10 students from the sample were grouped into one and demonstrated the purpose and technique of the test. Each student had performed the test in standing position, holding the peak flow meter horizontally without interfering with the movement of the marker or covering the slot. He/she asked to take keep breath then exhale it by forceful expiration as far as possible maintaining air tight seal between lips and mouthpiece of the instrument. Reading was taken in horizontal position. Each student given 3 chances to perform the test and the highest of the 3 values was taken into conisation.

Clinical interpretation of values of PEFR
Personal based value of PEFR can be compared to normal reference population and also with predicted value from regression equation[4-5]. Diurnal variation in PEFR is a good indicator of circadian bronchial liability responsiveness. PEFR records with diurnal variation of 20% or more is a good clinical and occupational indicator of asthma[6]. PEFR variability

diurnal variation in peak flow rate expressed as the formula as

Daily variability =

$$\frac{\text{Higher PEFR} - \text{Lowest PEFR}}{\text{Highest PEFR}} \times 100$$

Bronchial provocation test by exercise in 'exercise induced asthma' is diagnostic when PEFR falls 15% of personal based after exercise and reversibility of airway obstruction is evidenced by an increased in PEFR more than 20% after an adequate dose of nebulized bronchodilator is diagnostic for asthma, but bronchial reversibility of an increased at least 10% in PEFR after aerosol therapy is strongly suggestive of asthma[6].

Self management of bronchial asthma is advised to maintain a peak flow chart and personal based result should be interpreted in following ways:
- Green zone (Safe zone) - 80-100% of personal best result
- Yellow zone (Zone of alert)- <80%->50% of personal best result
- Red zone (Zone of emergency) - <50% of personal best result

Beasley et al presented a much more detailed plan, based on the first PEFR on the day before bronchodilator. If the PEFR is >70% of personal best, then maintenance regimen of twice daily inhaled bronchodilator and inhaled corticosteroid is continued. A value <70% of personal best result requires a period of doubling of the inhaled corticosteroid dose. At <50% of personal best result, a course of oral steroid is triggered, and the patient makes telephone contact with the physician[7].

Peak flow monitoring specially valuable for detecting deterioration of asthma, for predicting acute exacerbation of asthma and its management. Availability of peak flow measurement not only allows formulation of a management plan with criteria for both intensification of therapy and recourse to medical assistance. Regular measurement of peak flow allows objective determination of effect of therapy[8]. Peak flow measurement can be used to titrate maintenance treatment and deserve wider use in monitoring the adequacy of treatment of asthma.

- PEFR value >60% of expected- Admission probably unnecessary
- 40-60% of expected - Consider admission
- <40% of expected - Admission probably necessary[9].

Peak flow measurement is sensitive to the muscles of respiration. So, serial measurement of PEFR in Gullain Barre syndrome or progressive flaccid paralysis to predict the involvement of respiratory muscle is clinically important to give warning of the hypoventilation and need for ventilatory support.

The statistical software namely Microsoft word, excel had been used for graphs and tables. Graph pad instat, which reports exact p value was used for the inferential analysis. The student t test and ANOVA test where appropriate, were used to asses association between the variables. Age and BMI were analysed by one way analysis f variance followed by tukeys test. Gender was analysed by unpaired t test.

RESULTS

In our study in age group 5-6 years total no of male student was 50.72%(70) and female student 49.28%(68) , in 7-8years male 50.80%(72)and female 48.20%(67),in 9-10 years male50.68%(74) and female 49.32%(72) , in 11-12 years male50.31%(81) and female 49.69%(80) , in 13-14 years male 52.42%(65) and female 47.48%(59) . The ratio of male to female was 1.04 : 1.

Our study illustrates that the mean PEFR in age group 5-6 years was 146.5 (l/min) with SD 20.4 , in 7-8 years 182.4 with SD 32.65 , in 9-10 years 209.7 with SD 44.24 ,in 11-12 years 267.0 with SD 41.32 , in 13-14 years 285.3 with SD 43.36 . There is a positive correlation of PEFR with age as PEFR increases with increase in age and the correlation is found statistically significant. Our observations are also comparable with most of the studies which showed that age had significant effect on PEFR with positive correlation in children[10-12].

In our study the mean PEFR of male was 224.0 with SD 3.334 and that of female was 212.3 with SD 3.369.It illustrates mean PEFR of male was more than that of female and the correlation is significant. However, the factors that determine the PEFR, are predominantly expiratory muscle effect, lung elastic recoil, pressure and airway size. The muscle effort in turn depends on the physical strength and physical activity. It is possible that the lower values in girls were due to physiological reason and better performance of boys. It is in accordance to previous studies[13-14].

It illustrates the positive correlation of PEFR with weight as PEFR increases with weight and correlation is statistically significant.(table-1).Our study is in accordance with previous studies[14-15].

For same height there is no significant difference in boys and girls.(table-2,3). It is in accordance with previous studies[12, 16].

In my study mean PEFR (l/min) for body mass index of upto 15 was169.0 with SD 53.65 , 15.1-20.0 it was 218.0 with SD 59.28 ,for >20.0 it is 258.9 with SD 55. 19. There was increase in mean PEFR with increase

in BMI .So there is positive correlation between PEFR and BMI and the correlation is significant. In the present study PEFR correlated well with BMI.

Table-1:PEFR Levels According To Weight Distribution)

WEIGHT (kg)	No.	PEFR (L/min	
		Mean+/- SD	P value
10-20	29	126.2+/-13.47	<0.0001**
21-30	310	174.4+/-37.50	
31-40	256	246.3+/-46.14	
41-50	89	295.5+/-29.31	
>50	24	308.7+/-38.53	

Table-2:PEFR (L/min) in Relation To Height Interval

Height Interval (cm)	BOYS		GIRLS		'p' Value
	No.	PEFR (Mean ± SD)	No.	PEFR (Mean ± SD)	
110-120	29	136.2 ± 18.21	7	150.0 ± 24.49	Ns
120.5-130	136	169.6 ± 29.34	248	179.2 ± 35.08	Ns
130.5-140	117	235.7 ± 50.42	112	246.3 ±46.21	Ns
140.5-150	77	287.3 ± 39.22	46	278.3 ± 39.12	Ns
150.5-160	25	291.2 ± 42.06	20	273.0 ±51.91	Ns

Table-3: Pearson Correlation of PEFR & Anthropometric Parameters

PEFR Vs Parameter	Male		Female		All children	
	'r' value	'p' value	'r' value	'p' value	'r' value	'p' value
PEFR / Age	0.813	P<0.0001***	0.817	P<0.0001***	0.811	P<0.0001***
PEFR / Weight	0.805	P<0.0001***	0.834	P<0.0001***	0.816	P<0.0001***
PEFR / Height	0.805	P<0.0001***	0.834	P<0.0001***	0.819	P<0.0001***
PEFR / BMI	0.440	P<0.0001***	0.408	P<0.0001***	0.431	P<0.0001***

CONCLUSIONS

Diagnosis and management of obstructive air way diseases like bronchial asthma requires assessment of pulmonary function, specially ventilatory function. The peak expiratory flow rate (PEFR) measurement is a very simple, reliable, reproducible ventilator function test which can be performed by using mini Wright peak flow meter.

- PEFR correlated best with height, followed by with weight, age, BMI.
- Though mean PEFR of boys is little more than girls, there is no significant difference of PEFR between boys and girls for same height.
- PEFR for Boys =4.591*Height(cm)-393.03.
- PEFR for Girls =3.198*Height(cm)-217.92.
- The PEFR value of children of south odisha is less than that of other parts.(From the available data).This implies PEFR varies with geographical situation, environmental condition, life style of population.
- Results of this study can be used as a standard (PEFR value) for children of 5-14 year age group of south odisha
- Further study is needed to understand the difference (if any) present in other parts of Odisha.

REFERENCES

1. Silverman M, McKenzie S; Respiratory disorder. Campbel AGM, McIntosh N (eds), Forfar and Arneil's Text Book of Pediatrics,5th edn, 1998; 489-501. London, Churchill Livingstone.
2. Lebowitz MD; The use of peak expiratory flow rate measurements in respiratory disease. Pediatr pulmonol, 1991; 11:166-174.
3. Swaminathan S; Pulmonary function testing in office practice. Indian J Pediatr, 1991; 66:905-914.
4. Pande JN, Mohan A, Kchilnani S, Khelnani GC; Peak expiratory flow rates in school going children. Indian-J-Chest-Dis-Allied sci, 1997;39(2): 87-95.
5. Gregg I,Nunn AJ; Peak expiratory flow in normal subjects. Br Med J; 1973;4: 282-284.
6. Brown LA, Sly RM;Comparison of mini-Wright and standard Wright peak flow meters. Ann Allergy, 1998;45:72-74.
7. Cross D, Nelson HS; The role of the peak flow meter in the diagnosis and management of asthma. J Allergy Clin. Immunol, 1991; 87(1):120-128.
8. Boggs PB, Wheeler D, Washburne WF, Hayati F;Peak expiratory flow rate control chart in

asthma care: chart construction and use in asthma care. Ann Allergy Asthma Immunol,1998; 81(6):552-562.

9. Taylor MR; Asthma: audit of peak expiratory flow rate guidelines for admission discharge. Arch. Dis Child, 1994; 70(5): 432-434.

10. Jain SK, Kumar R, Sharma DA; Peak expiratory flow rate in relation to anthropometric measurements in normal Indian subjects. East Afr Med J, 1982;59(9):593-598.

11. Malik SK, Jindal SK, Sharda PK, Banga N; Peak expiratory flow rate of healthy school boys from Punjab. Indian Pediatrics. 1981; 19:161-164.

12. Paramesh H; Normal PEFR in urban and rural children. Indian J Paediatric; 2003; 70(5): 375-377.

13. Chowgule RV, Shetye VM and Parmar JR; Lung function tests in normal indian children. Indian Pediatr, 1995; 32(2): 185-191.

14. Zadehi MI; Normal values of PEFR in children from Town of Babol, Iran, Iran J. Allergy Asthma Immol, 2006; 5(4), 195-198.

15. Al-Dawood K; Peak expiratory flow rate in Saudi School Boys at Al – Khobar City, Saud Arabic, Saudi Medical Journal, 2000; 21(6):561-564.

16. Godfrey S, Kamburof PL, Nairn JR; Spirometry, lung volumes and air ways resistances in normal children aged 5-18 years. Br. J. Dis. Chest, 1970; 64: 15-24.