Chattogram Maa-O-Shishu Hospital Medical College Journal
Volume 18, Issue 1, January 2019

Original Article

Peak Expiratory Flow Rate Among Rural and Urban Normal School Children in Chattogram, Bangladesh

A K M Zafarullah[1*]
Md. Badrul Alam[2]
Moinuddin Ahmed[2]
Ashutosh Das[3]
Md. Shah Alam[4]

[1]Department Pediatrics
Chattogram General Hospital
Chattogram, Bangladesh.

[2]Department Pediatrics
Chattogram Medical College
Chattogram, Bangladesh.

[3]Department Pediatrics
Feni Sader Hospital
Feni, Bangladesh.

[4]Department Pediatrics
Chandanaish Upazila Health Complex
Chattogram, Bangladesh.

*Correspondence to:

Dr. A K M Zafarullah
Senior Consultant
Department Pediatrics
Chattogram General Hospital
Chattogram, Bangladesh.
Mobile : +88 01711 27 08 77
Email : zafardr.2016@yahoo.com

Date of Submission : 27.12.2018
Date of Acceptance : 03.02.2019

www.banglajol.info/index.php/CMOSHMCJ

Abstract

Background: *Asthma remain the most common chronic inflammatory lung disease in childhood. Asthma management needs lung function assessment. Peak Expiratory Flow Rate (PEFR) is one of the lung function test. PEFR has been used as measure of ventilatory capacity for long mainly because of a simple, less tiring procedure than other lung function test. It is easy to use, inexpensive, portable, reliable can be used by patients, parents, home & clinic. There is no national nomogram on PEFR in Bangladesh. We always use the nomogram of other countries for diagnosis, management of Asthma. This study was taken to establish what is the normal pattern of PEFR in Bangladeshi children of rural and urban area and to construct nomogram of PEFR in healthy Bangladeshi children.*

Materials and methods : *It is a cross sectional study conducted in different 6 schools (Urban & rural) in Chattogram District of both sexes (5-15 yrs old) in equal proportion of child. Study period was from April 2009 to November 2009 under supervision of Pediatrics Department of Chattogram Medical College. Sample was selected by non-probability technique. Data were collected by pre-tested questionnaire including exclusion criteria.*

Results: *A total of 1424 healthy school children (Age 5-15 yrs) of equal sexes of both rural and urban school were included during study. The best of three PEFR of boys ranged from 90 to 750 l/min (Mean 291 l/min, SD 143) and in case of girls ranged from 80 to 540 (L/min (mean 236 L/min, SD 94.38). The positive correlation of PEFR with various anthrometric parameters specially height and observed difference with boys and girls. The most significant correlation was observed PEFR with height and also found different value of PEFR between rural and urban children.*

Conclusion : *This study concluded that there is significant difference of PEFR between Bangladeshi boys and girls (5-15 yrs). Height is the best predictor of PEFR value than any other anthrometric parameters PEFR value of Bangladeshi Girls is lower than that of Boys and significant difference between PEFR values among urban & rural Bangladeshi children.*

Key words: Bronchial Asthma; PEFR; Children.

INTRODUCTION

There are many lung function tests used clinically and epidemiologically to measure status of lung function, which help to asses lung diseases[1,2]. Most of the lung diseases effect ventilatory status of the organ. Ventilatory function Studies provide a better understanding of functional changes in the lungs and their significance from

the view points of diagnosis. Ventilatory function can be assessed by Spirometry, Bronchial provocative tests, Peak Expiratory Flow Rate (PEFR) Gas dilution, Diffusion of gas (Gas exchange) Perfusion, Ventilation-perfusion etc[3]. Though these tests do not provide a specific diagnosis, they help us to understand the physiology, course, the severity and prognosis of the respiratory diseases and thus help us the management of numbers of respiratory diseases[4].

PEFR has been used as measure of ventilatory capacity for long mainly because of a simple and less tiring procedure than other lung function tests. PEFR is the maximum speed at which a person can exhale air from the lung in a single breath or PEFR is the greatest flow velocity that can be obtained during a forced expiration, standing with fully inflated lung or it is measurement how faster a person can blow out.

Asthma remains the most common chronic inflammatory long disease in childhood[5]. Childhood Asthma in Bangladesh appears to substantial health problem[6,7]. About 5 million children in Bangladesh are victim of Asthma[6]. Prevalence of Asthma in Children is increasing day by day and is a major global health problem which exert a substantial burden on the family and health care service and the society as a whole[8].

The PEFR measurement can reveal diurnal variability of airway of patients suffering from reactive airway disease but not in normal children[9]. that gives the early clue to have the diagnosis and management[10]. Daily measurement of PEFR can be used as a guideline for Br. asthma management as like assessment of urinary sugar in diabetic patient by physician[4,11]. As PEFR varies on age, sex, height, weight and ethnicity. In our country there is no nomogram on PEFR. We always use the nomogram of other countries for diagnosis and management of Bronchial astha, as we do not have our own. From this point of view this study was undertaken to determine a normal PEFR pattern in Bangladeshi urban & rural normal children and whether any difference exists among rural and urban children and also to construct a nomogram on PEFR of Bangladeshi normal children.

MATERIALS AND METHODS

It is a cross sectional study conducted in different 6 schools (Both urban & rural) in Chattogram District of both sexes in equal proportion of child (5-15yrs). Study period was from April 2009 to November 2009 under supervision of Pediatrics Department of Chattogram Medical College. Sample was selected by non-probability (Purposively sampling) technique. Data were collected by pre-tested questionnaire with exclusion criteria. All the primarily selected students were interviewed for inclusion in the study. The student having asthma, atopy, wheeze, eczema, chest deformity, acquired heart disease TB and malnutrition were also excluded from the study. Information were taken from parents (KG to class III) & directly from students (Class IV to Class X). The schools are situated in various areas of the Chattogram district including metropolitan and rural area. Schools were selected by purposive sampling technique. Considering the age (5-15) years with equal gender and socioeconomic status. Written consent was taken from headmaster / principle of the institution. Height was measured by stadiometer in standing position with Frunkfurt line, weight was recorded by bathroom scale without shoes and minimum clothes. Five well functioning mini Wright peak flow meter (m WFEM) (2 ranging from 50-350 L/min and 3 ranging from 60-800 L/min). Students were demonstrated how to use m WPFM correctly and repeatedly most of them were given trials 3-4 times before performing the work. Then serial 3 blows for PEFR was registered in the individual sheet after the child has become familiar with the technique. Highest reading was taken as representative value. All the collected data were checked consistancy and verified for its compiled. The data were complied, analyzed and then tabulated according to key variables. The Statistical programs SPSS V.12 for Windows was used to calculate correlation coefficients and mean age, heights, weight and body surface area. The study protocol was reviewed earlier and approved by Ethical Review Committee (ERC) of Chattogram Medical College.

RESULTS

The study population included 1424 (712 from urban and 712 from rural) with equal distribution of sex and equal ratio from rural and urban inhabitance, of six different school of Chattogram. The positive correlation of PEFR with height, age, weight and body surface area was observed in both the boys and girls which means that the value of PEFR increased with increase in those anthropometric parameters.The most significant correlation was observed PEFR with height (T-I, $p< .001$). Age was found second variable had positive correlation with PEFR, among boys and girls ($p< .001$) and body surface area ($p< .001$). In this study also found PEFR of girls in relation to height were always lower than that of boys (Table –II). The age range of boys was between 60 to 190 months (mean age 127 months, SD 37.94) and girls was 60 to 190 months (Mean age 126 months, SD 37.01). The height range of boys was 88 to 188cm. (Mean 140cm, SD 17.60). Girls' was 90-168cm (Mean 139cm, SD 14.86). The best of three PEFR of boys ranged from 90 to 750 I/min (Mean 291 I/min, SD 143) and in case of girls ranged from 80 to 540 (L/min (Mean 236 L/min, SD 94.38). High significant correlation of PEFR was found with heigh (T-II), body weight, body surface area and age (Table-II). This study also found difference value of PEFR in rural and urban children ie PEFR were lower in rural children than urban ($p<. 05$). (Table III). Prediction equation of PEFR for boys PEFR [L/min)= 6.84Í height (cm)- 658.32] and for girls PEFR [L/min)= 4.64 Í height (cm)- 390.99] derived from regression analysis where PEFR of individual person was considered dependent variable and height as an independent variable. From These prediction equation we enabled to construct the nomogram of normal PEFR for Bangladeshi boys and girls (Figure l & 2). PEFR of Bangladeshi children were comparable with that of different countries of the world (Table-IV). The PEFR value of Bangladeshi normal children is a bit lower than other countries in the world.

Table I : Pearson correlation coefficient (r) and level of significance between mean PEFR in L/min and anthropometric parameters

Parameters		Correlation with	Correlation Coefficient	p Value	Sig.
Height of the	Total (n = 1424)	Mean	0.824	0.000	p < 0.001
Children in	Boys (n = 714)	PEFR	0.873	0.000	p < 0.001
Cm	Girls (n = 710)	In L/min	0.774	0.000	p < 0.001
Weight of the	Total (n = 1424)	Mean	0.790	0.000	p < 0.001
Children in Kg	Boys (n = 714)	PEFR	0.852	0.000	p < 0.001
	Girls (n = 710)	In L/min	0.753	0.000	p < 0.001
Body Surface	Total (n = 1424)	Mean	0.792	0.000	p < 0.001
Area	Boys (n = 714)	PEFR	0.853	0.000	p < 0.001
in Sq. M	Girls (n = 710)	In L/min	0.765	0.000	p < 0.001
Age of the	Total (n = 1424)	Mean	0.812	0.000	p < 0.001
Children	Boys (n = 714)	PEFR	0.854	0.000	p < 0.001
In Months	Girls (n = 710)	In L/min	0.831	0.000	p < 0.001

Table I: Shows the summary of correlation coefficient (r-value) and the level of significance between different anthropometric parameters and PEFR in case of boys and Girl Highly significant correlation was observed in all anthropometric parameters but height correlated with PEFR (L/min) more than any other parameters.

Table II : Mean PEFR in L/min of Bangladesh normal children in relation to height interval (n= 1424)

Height interval CM	n	BOYS (n=714) Mean PEFR (±SD)	n	GIRLS (n= 710) Mean PEFR (±SD	p Value
80.5-90	1	86.67	0	-	
90.5-100	0	-	3	85.56(±6.94)	
100.5-110	39	93.93(±19.70)	36	87.96(±12.43)	
110.5-120	57	109.82(±34.21)	63	114.18(±35.65)	
120.5-130	143	149.11(±47.52)	111	144.56(±45.88)	p<0.001
130.5-140	144	200.76(±59.09)	139	180.24(±60.32)	
140.5-150	87	259.08(±62.33)	175	246.99(±65.52)	
150.5-160	133	369.32)±76.09)	170	294.42(±63.86)	
160.5-170	100	452.17(±90.55)	13	304.87(±63.28)	
170.5-180	9	551.11(±95.14)	0	-	
180.5-190	1	316.67	0	-	

Df. 14 t= 0.145 p>0.1 (Between model 1 & model 2)

Table II : Shows distribution of PEFR (L/min) according to height interval of normal children (5-15 years) in boys and girls. The values of PEFR of girls were significantly lower than that of boys.

Table III : Mean PEFR by Inhabitance & Sex (Rural & Urban)

	Inhabitance & sex of study group	n	Mean	Std. Deviation	Std. Error Mean	p Value
Mean PEFR	Urban	712	238.8530	118.43689	4.43861	0.050
in L/min	Rural	712	226.5272	118.10908	4.42632	
Mean PEFR	Boy	714	255.4575	137.97773	5.16369	0.000
in L/min	Girl	710	209.7944	89.10685	3.34412	

Table III: Shows rural children are lower PEFR value than urban children (p<0.050)

Table IV : Comparison of PEFR value of the present study with other studies else where in the world

Studies	120 cm (Height)		140cm (Height)		160 cm (Height)	
	Boys	Girls	Boys	Girls	Boys	Girls
Present Study, 2009	165	160	299	259	436	352
S. Rajesh Anil Jain et al, 2003 Rajesthan, India[12]	199	186	286	274	372	361
Swaminathan et al, 1993, Madras[13]	205	193	386	272	368	350
Mridha MA Amin R. 2002, Dhaka Bangladesh[14]	220	205	340	319	458	433
Malik et al, 1981/82, Punjab[15,16]	222	216	320	314	418	412
Bejaponpitak et al, 1999, Thailand[17]	236	214	306	283	377	352
Host et al, 1994, Denmark[18]	236	219	321	308	420	416
Udupihille et al, 1994, Sri Lanka[19]	271	254	403	367	507	478
Kashyap et al, 1992; Tribal; India[20]	202	170	304	263	405	352
Sanz et al, 1990, Australia[21]	252	237	352	341	452	445
Carson et al, 1989, Dublin[22]	222	213	342	324	461	435
Wall et al, 1982, North America[23]	240	228	327	319	450	427
Parmaretal, 1977, India[24]	198	229	300	312	400	398
Godfrey et al, 1970, UK[25]	212	211	318	317	423	422

Table IV: Comparison of values of PEFR (l/min) Predicted from regression equation in relation to height in studies of different places of the world. It revealed that excepting a few studies PEFR value obtained in present study was more or less similar with other studies.

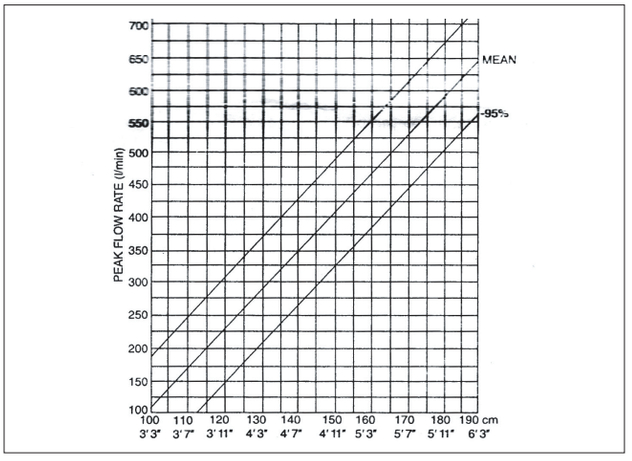

Figure 1 : Nomogram of normal mean PEFR of Bangladeshi Boys in Relation to Height

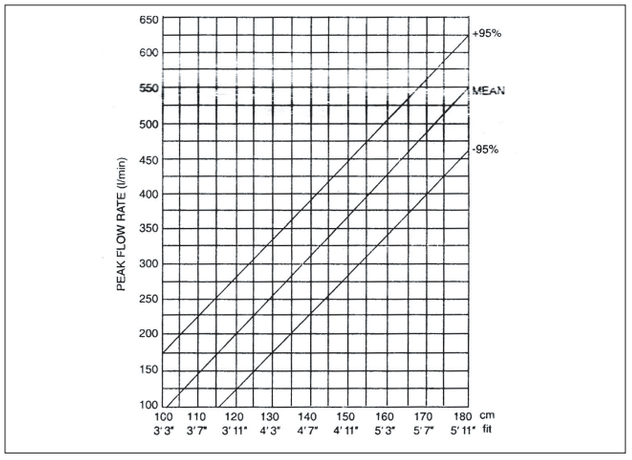

Figure 2 : Nomogram of normal mean PEFR of Bangladeshi Girls in Relation to Height

DISCUSSION

Peak Expiratory Flow Rate (PEFR) recording is an essential measure in the evaluation, monitoring, management and follow up of patients with bronchial asthma. Peak Expiatory Flow Rate (PEFR) is a lung function test which is easily measurable and reproducible but base line value of PEFR has not been studied in large scale among Bangladeshi children. This study found strong correlation between PEFR with height, age, sex and body surface area. The regression equations for PEFR were determined for boys and girls considering height and age weight, body surface area,separately as independent variable[26]. Correlation of height with PEFR was the highest in comparison to other anthropometric parameters (Age, body weight and body surface area). This study found boys had significantly higher values of PEFR than that of girls at any height[24,20]. The difference of PEFR in boys and girls were also observed by other investigations[14,13,24,17]. But some study observed equal value of PEFR in both sexes[25,26]. PEFR values of Bangladeshi children were slightly lower to British and nearly, similar to Indian children but lower than tha of Srilankan children[15,16,19,27]. Studies in neighboring countries (Srilanka[19], India[15], Thailand[17]) observed that PEFR in boys was significantly higher than the girls which strongly support the findings of the present study. Our study was found that PEFR values of rural children was lower in that of urban children. which was significant ($p < .05$) which also support our hypothesis. When mean PEFR (L/min) values calculated from prediction formula of different studies with different height to compare our result was revealed that mean predicted PEFR values of present study is lower. The previous Bangladesh study (In Dhaka city) found abit higher value than present study (It is possibly due to inclusion of both rural and urban children in present study)[14]. Nomogram were constructed in relation to height and in relation to age separately for boys and girls as applying the principle of other study else where in the world[25,13,15,20]. Findings of this study suggested to prefer height based nomogram to age based nomogram because height correlated best with PEFR as height should have the first preference for prediction of PEFR because of more accuracy, easily measurable at any place and its highly significant relationship with PEFR. Our present study results appear to be reliable as we include both rural and urban children and large sample size in present study.

CONCLUSION

This study concluded that there is significant different of PEFR between Bangladeshi boys and girls (5-15 yrs). Height is the best predictor of PEFR value than any other anthrometric parameters age, body weight and body surface area also correlates with PEFR but less predictive in comparison to height. PEFR value of Bangladeshi girls is lower than that of boys. There is a significant difference between PEFR values among urban & rural Bangladeshi children. The PEFR value of Bangladeshi children is slightly lower than other countries (It is possibly due to inclusion of both rural an urban children in present study).The result of this study may be use as PEFR of Bangladeshi normal boys and girls.

RECOMMENDATION

Further study is needed to include more variable to find out the affects of variables (If any) on PEFR values and also include more areas of Bangladesh and large sample size among normal Bangladeshi children.

DISCLOSURE

All the authors declared no competing interest.

REFERENCES

1. Lebowitz MD. The use of peak expiratory flow rate measurements in respiratory disease. Pediatr pulmonol. 1991;11:166-174.
2. Swaminathan S Pulmonary functin testing in office practice. Indian J. Pediatr. 1999;66: 905-914.
3. Amdekar YK, Ugra D. Pulmonary Function tests". Indian J Pediatr. 1996;149-152.
4. Cross D and Nelson. The role of the peak flow meter in the diagnosis and management of asthma J. Allergy Clin. Immunol. 1991;87 (1) : 120-128.
5. Hasan MR, Kabir ARML, Mahmud AM, Rahman F, Hossain MA, Bennor KS, et al.Self reported asthma symptoms in children and adults of Bangladesh: Finding of the National Asthma Prevalence Study.International of Epidemiology. 2002; 31 : 483-488.
6. Kabir ARML, Rahman F, Hassan M Rashidul,Prevalence of reported asthma symptoms in children of Bangladesh. 1999.
7. Kabir ARML, Hassan Mr, Rahman AKMF. First nationa asthma prevalence study (NAPS) in Bangladesh. 1999.
8. Mutius EV. The burden of childhood asthma. Arch Dis Child. 2000; 82(Suppl 11) ii2-ii5.
9. Sly PD, Hibbert ME, Diurnal variation of peak expiratory flow rate in asthmatic children. pediatr pulmonol. 1986; 2 (3) :141-146.
10. Taylor Mr. Asthma: Audit of peak expiratory flow rate guidelines for admission discharge. Arch. Dis Child. 1994; 70 (5) : 432-434.
11. Dugdale AE, Moeri M. Normal values of forced vital capacity (FVC), forced expiratory volume (FEV 1.0), and peak flow rate (PFR) in children. Arch Dis. Childh. 1968;43; 229-233.
12. Rajesh S, Jain Anya A, PEFR of School going Children age 5-14 years from Ajmir District. Indian pediatrics. 2002;39(1):75-78.Rajasthan, India.
13. Swaminathan. Peak expiratory flow rate in south Indian Children Indian Pediatric. 1993; 30(2):207-211.
14. Mridha MA, Amin R. peak expiratory flow rate of 5-15 years children" Bangladesh J Child Health. 2002;26(3/4):46-51.
15. Malik SK, Jindal SK, Sharda PK, Banga N. Peak expiratory flow rates of school age girls from Punjab (Second Report). Indian Pediatrics 1982; 18 : 517-521.
16. Malik SK,Jindal SK,Sharda PK,Banga N.Peak expiratory rate of healthy school boys form Punjab.Indian pediatrics. 1981; 19: 161-164.
17. Benjaponpitak S,Direkwattanachai C,Kraisarin C,Sasisakulporn C. Peak expiratory rate values of students in Bangkok. J Med Assoc Thai. 1999; 82(suppl)1:S 137-143.
18. Host-A, Host AH, lbsen-T. Peak expiratory flow rate in healthy children aged 6-17 years. Acta-Paediatrics 1994; 83:1255-1257.
19. Uduphille-M. Peak flow rate in Srilanka school going children of Sinhalese ethnic origin 1984. Respir-Med. 1984;88(3): 219-227.
20. Kashyap S, Puri DS, Bansal SK. Peak expiratory flow rates of healthy tribal children living at high altitudes in the Himalayas. Indian Pediatrics. 1992; 29 : 283-286.
21. Sanz J, Martorell A, Saiz R, Alvarez V, Carrasco Jl, Peak expiratory flow measured with the mini Wright peak flow meter in children. Pediatr Pulonol. 1990; 9:86-90.
22. Carson JWK, Hoey H ,Taylor MRH. Growth and other factors affecting peak expiratory rate.Arch Dis child. 1989;64:96-102.
23. Wall MA, Olson D, Bonn BA, Creelman T, Buist AS. Lung function in North American Indian Children: Reference standards for spirometry, maximal expiratory flow volume curve and peak expiratory flow. Am Rev Respir Dis. 1981; 125:158-162.
24. Parmar VR, Kumar L, Malik SK. Normal values of peak expiratory flow rate in healthy North Indian school children,6-16 years of age. Indian Pediatrics 1977;1XIV (8) : 591-594.
25. 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.
26. Graff-Lonnevig-V, Harfi H, Tipirneni-P. Peak expiratory flow rate in healthy Saudi Arabian children living in Riyadh. Ann Allergy. 1993; 71: 446-450.
27. Nunn AJ, Gregg I. New regression equations for predicting peak expiratory flow in adult. BMJ. 1989; 198:1068-1070.