International Research Journal of Medical Sciences _____ ISSN 2320 –7353
Vol. **2(12),** 1-3, December **(2014)** *Int. Res. J. Medical Sci.*

Peak Expiratory flow rate and its Correlation with age in normal School Children

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Available online at: www.isca.in, www.isca.me
Received 18th September 2014, revised 30th October 2014, accepted 17th December 2014

Abstract

Aims- The aim of this study was to correlate the "PEAK EXPIRATORY FLOW RATE "as measured by miniature Wright Peak Flow Meter in normal school children between 5 – 18 years with Age. Objectives- This study was done to correlate Age of healthy school children with PEFR Studyarea - R.G.M. School Sindhanur. Study design- This is an observational study of 495 urban school going healthy children from SINDHANUR. This sample comprised of 268 boys and 227 girls in the age range of 5- 18 years. Results- PEFR increases linearly with increase in Age. The correlation of PEFR with Age was statistically significant. Conclusion- The present study has led to the following conclusions. A. There is a positive and statistically significant correlation between PEFR and AGE in the sample of children selected. B. AGE has a close correlation with PEFR.

Keywords; Peak Expiratory Flow Rate (PEFR), Peak Flow Meter, S.D. (Standard Deviation), C.V.(Coefficient of Variation), S.E.M.(Standard Error of Mean).

Introduction

The physiological principles underlying pulmonary function in health and disease were understood in surprising detail during past three hundred years[1]. The pulmonary function tests have not only widened the knowledge about the functional capability of the lungs in normal healthy persons but also have made it possible to assess the functional abnormalities in persons with restrictive and obstructive airway disorders both qualitatively and quantitatively[2]. The important functional abnormality in patients disabled by asthma, bronchitis, emphysema and other COPDs (Chronic Obtructive Pulmonary Disorders) is the difficulty in expiration[3]. Hence the measurement of Peak Expiratory Flow Rate (PEFR) has gained worldwide acceptability as a method for identification, assessment, rational therapy and follow up of such patients.

PEFR is defined as the maximal expiratory flow rate which can be sustained by a subject for at least 10 milliseconds during forced expiration starting from total lung capacity[4]. PEFR is expressed in litres/min. PEFR is influenced by various factors such as age, sex, height, weight, and body surface area, environmental and ethnic differences[5]. The measurement of PEFR is of value for the identification of chronic obstructive bronchitis and for assessment and follow up of patients with asthma. It is also very useful in the assessment of severity of airway obstruction. The Wright Peak Flow Meter, which was designed as a simple and reliable device is used for measuring PEFR[6]. This instrument has undergone many changes and reached its present form known as the miniature Wright Peak Flow Meter. For the purposes of evaluation of an observed reading of PEFR, a knowledge of its range in normal subjects of the same sex, age and body size is required[7].

Material and Methods

Selection of subjects: The present study reports normal values for PEFR in 495 normal children from 5–18 years of age, measured using a miniature Wright Peak Flow Meter (MWPFM). These children constitute a representative cross section of normal school children. Students of both sexes were selected randomly from the primary, middle and high school (of R.G.M. School Sindhanur)

The following criteria were employed for acceptance as a Normal subject: No history of cardiopulmonary disease. No clinical evidence of cardiopulmonary disease. No history or evidence of any other disease which could be expected to affect pulmonary function. Capable of adequate co-operation.Children willing to participate with the consent of parent/guardian.

The instrument: Peak flow meter: Background: The Peak flow meter was introduced in 1959 by B.M. Wright. This device became popular soon after, but was expensive, cumbersome & too sensitive for routine clinical use. However the concept of Peak flow rate caught on and efforts to develop a cheaper, simple and portable instrument to measure the same got under way. Thus was born in 1969, the miniature Wright Peak Flow

Meter, commercial production of the same began in 1977.

The mini Wright peak flow meter: The mini Wright peak flow meter operates on a spring loaded piston and a longitudinal slot as a variable orifice, which carries a rider or marker as Peak flow indicator. These are housed in a cylindrical plastic frame of dimension 5.0 cm diameter and 15 cms length. The instrument weighs 75 gms.

Operation and use: Air blown into mouth piece cannot escape until it has moved and uncovered part of the longitudinal slot. When the area of the slot uncovered is such that the pressure behind the piston is just enough to balance the tension in the spring, the piston comes to rest in a position that depends on the flow rate.

The purpose and technique of the test was described to the subjects in groups of ten and the method of blowing into the instrument was demonstrated. Each subject then held the instrument and had several trial blows, until it was clear that he/she was using the meter properly and comfortably (this usually required 2-4 blows). Each was encouraged to make a maximal effort and was closely watched to ensure that he/she maintained an airtight seal between the lips and mouth piece of the instrument. Each child blew five times into the flow meter and three maximum readings were recorded.

Results and Discussion

The children in 5–8 years age group had a mean PEFR of 202.10 L/Min. with a S.D. of 37.50; the children in 9–12 years age group had a mean PEFR of 309.51 L/Min. with a S.D. of 43.07; the children in 13–16 years age group had a mean PEFR of 424.22 L/Min. with a S.D. of 48.08; the children in 17–18 years age group had a mean PEFR of 489 L/Min with a S.D. of 47.63.

PEFR and Age: The mean age of the 268 boys was 11.4 years with a S.D. of 3.64. The mean age of 227 girls was 10.9 years with a S.D. of 3.60. The mean age of all the 495 students was 11.5 years with a S.D. of 3.58. The mean PEFR with respect to age grouping with S.D. ; C.V. and S.E.M of all the subjects , boys and girls are shown in Table 3.

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The growth of children occurs in phases during the childhood and adolescent periods. The PEFR readings which is dependent on musculoskeletal growth, nutrition and B.S.A increases progressively with age. This increasing trend of PEFR with age can be evidently observed from the above mentioned values. These values are also comparable with the values obtained in a similar study by Malik.S.K. et al[8].

PEFR correlates positively with Age. The correlation is statistically significant as shown by the correlation co-efficient values i.e., r = 0.963 in boys , 0.958 in girls and 0.953 when both sexes are combined and P value less than 0.001 in all the cases. The mean PEFR of boys in various age groups is higher than those of girls of corresponding age. The abrupt increase in PEFR and the difference of PEFR between the sexes are significant after the age of 12 years. This increase can again be attributed to considerable variation in the age of onset of puberty in the two sexes and also the different rate and manner in which the two sexes reach physical maturity. The values and views cited above are comparable to and are in confirmation with the observations of Nairn.J.R. et al, Parmar V.R. and Malik S.K. et al[9].

Regression equations based on Age for predicting PEFR in different sexes are as follows;

Boys : PEFR = - 1.74 + 30.14 x Age in years.
Girls : PEFR = 38.71 + 24.13 x Age in years.
Common eqn : PEFR = 14.54 + 27.93 x Age in years.

Table 1
The mean PEFR with S.D., C.V and S.E.M of Boys with respect to Age

	Boys (n = 268)		PEFR (L / Min.)		
Age(Years)	No	Mean	S.D.	C.V %	S.E.M
5 - 8	71	206.19	35.34	17.14	4.19
9 - 12	79	311.77	48.07	15.41	5.4
13 – 16	103	439.51	48.68	11.08	4.8
17 – 18	15	527.33	32.55	6.17	8.4

Table 2
The mean PEFR with S.D. , C.V and S.E.M of Girls with respect to Age

	Girls (n = 227)		PEFR (L / Min.)		
Age(Years)	No	Mean	S.D.	C.V %	S.E.M
5 - 8	67	197.76	39.2	19.82	4.79
9 - 12	85	307.41	37.7	12.26	4.09
13 – 16	60	397.67	33.23	8.36	4.29
17 – 18	15	450.67	23.23	5.15	5.99

Table 3
The mean PEFR with S.D., C.V and S.E.M of All Subjects with respect to Age

	Total (n = 495)		PEFR (L / Min.)		
Age(Years)	No	Mean	S.D.	C.V %	S.E.M
5 - 8	138	202.1	37.5	18.56	3.19
9 - 12	164	309.51	43.07	13.91	3.36
13 – 16	163	424.22	48.08	11.34	3.77
17 – 18	30	489	47.63	9.74	8.7

For the above discussion, the statistically highly significant relation of PEFR and Age is evident.

Though full efforts have been made to get the subjects best cooperation it is possible that some of the children might not have given their best performance during the test. Also some might not have recalled the previous history of chest illness correctly and might have had subtle grade of asymptomatic small airways obstruction which is not detectable by PEFR test.In addition genetic makeup of the individual which contributes to one third of the phenotypic expression, also influences the performance of the individual. The Co-efficients (r) of PEFR obtained in the present study has been compared with those of other work done in North India and Western Countries[10]. The values in different studies are in close concordance with each other.

Conclusion

PEFRs were measured in a sample of 495 urban school going children from SINDHANUR. This sample comprised of 268 boys and 227 girls in the age group 5-18 years. The mean values of age, height, weight, B.S.A. and PEFR were 11.5 yrs, 140.21 cms, 32.84 Kgs , 1.14 Sq.mts and 328.18 L/min respectively. The correlation of PEFR with Age was statistically significant. With the detailed statistical analysis and discussion it is quite evident that the present study is statistically highly significant and can be considered as a standard reference for the child population of South India.

The present study has led to the following conclusions: There is a positive and statistically significant correlation between PEFR and AGE. AGE has a close correlation with PEFR.

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