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Original Article

Correlation of Age, Height and Weight with Peak Expiratory Flow Rate in Children

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ABSTRACT:

Background: Peak Expiratory Flow Rate is a convenient and reliable measurement in diagnosing and monitoring the progress of airflow limitation and evaluating the response to treatment. The present study was conducted to correlate age, height and weight with PEFR in study population. **Materials & Methods:** This study included 520 subjects. All the parents filled a self-administered questionnaire to obtain general information. Age of each subject was obtained from children date of birth certificate. Height and weight were measured according to a standardized protocol. PEFR was measured with mini-Wright compatible 'asthma plan peak flow meter' which had a range of 50- 800 L/min and readable to the nearest 10 L/min. **Results:** It included 260 boys and 260 girls. The difference was non- significant (P-1). Age, height, weight and PEFR were higher in boys than girls. The difference was significant (P< 0.05). Girls achieved pubertal changes at younger age when compared to boys. As analyzed by Tanner staging. **Conclusion:** PEFR is positively correlated with age, height and weight of subjects. This is one of the indicator for respiratory diseases commonly seen in children.

Key words: Height, Peak Expiratory, Weight

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INTRODUCTION

The peak expiratory flow (PEF), also called peak expiratory flow rate (PEFR) is a person's maximum speed of expiration, as measured with a peak flow meter, a small, hand-held device used to monitor a person's ability to breathe out air. It measures the airflow through the bronchi and thus the degree of obstruction in the airways. Peak Expiratory Flow Rate (PEFR) is a convenient and reliable measurement in diagnosing and monitoring the progress of airflow limitation and evaluating the response to treatment.[1]

Chronic respiratory diseases are among various diseases common in children. Asthma is the most common obstructive disease in children. It has been seen that respiratory diseases leads 4 million deaths annually; and 250,000 people die of asthma. It has high mortality and morbidity rate.. Early diagnosis is important to reduce suffering and mortality.[2]

Age, sex, height, weight, diurnal variation and race are factors affecting PEFR. PEFR in infants, children and adults differ between different ethnic groups. Since the growth and development are affected by pubertal hormones, pubertal stage also is likely to affect PEFR.[3]

PEFR readings are higher when patients are well and lower when the airways are constricted. From changes in recorded values, patients and doctors may determine lung functionality, the severity of asthma symptoms, and treatment. Due to the wide range of 'normal' values and the high degree of variability, peak flow is not the recommended test to identify asthma. However, it can be useful in some circumstances. A small portion of people with asthma may benefit from regular peak flow monitoring.[4] When monitoring is recommended, it is usually done in addition to reviewing asthma symptoms and frequency of reliever medication use. When peak flow is being monitored regularly, the results may be recorded on a peak flow chart. It is important to use the same peak flow meter every time.[5] The present study was conducted to correlate anthropometric measurements with PEFR in study population.

MATERIALS & METHODS

This study was conducted in the department of Physiology in year 2012. It included 520 subjects of 7- 14 years of age. All were informed regarding the study and written consent was obtained from the parents.

All the parents filled a self-administered questionnaire to obtain general information and disease history of the participant. Children with asthma, tuberculosis, with symptoms such as cough, breathlessness, hemoptysis and wheezing, chronic heart failure were excluded. Age was obtained from children date of birth certificate. Height and weight were measured according to a standardized protocol.

PEFR was measured with mini-Wright compatible 'asthma plan peak flow meter' which had a range of 50- 800 L/min and readable to the nearest 10 L/min. The measurement was made while the subject was in erect position and instructed to take maximum inspiration and to blow as hard as possible without any delay while keeping a tight seal around the mouth-piece. Three readings were obtained. If the difference between largest two values was less than 10% of the highest value, the highest reading was considered for analysis. Results were tabulated and subjected to statistical analysis using Statistical Package for Social Science (SPSS). P value <0.05 was considered significant.

RESULTS

Table I shows that out of 520 subjects, boys were 260 and girls were also 260. The difference was non- significant (P-1). Table II shows that there was significant difference in height, weight and PEFR in all age groups. All parameters were higher in boys as compared to girls. The difference existed in both genders and P value was less than 0.05. Table III shows Tanner pubertal staging and the mean age, height and PEFR for each pubertal stage in boys (a) and girls (b). Girls achieved pubertal changes at younger age when compared to boys. When the difference of PEFR between the stages of the same sex was analyzed, the increase at each stage was statistically significant (P<0.05) in boys and girls.

Table I Distribution of subjects

Total - 520		
Boys	**Girls**	**P value**
260	260	1

Table II Height, weight and PEFR in each age group

	Boys (mean) (SD)			Girls (mean) (SD)			
Age yrs	**Ht cm**	**Wt cm**	**PEFR L/min**	**Ht cm**	**Wt cm**	**PEFR L/min**	**P value**
7	120	20.1	140	118.4	18.6	134	0.01
8	124.6	23.3	158	122.6	21.2	153	0.04
9	130.4	26.8	172	132.2	24.4	168	0.02
10	134.2	30.2	188	136.6	28.2	182	0.05
11	140.2	32.6	206	142.4	30.4	200	0.02
12	146.4	34.5	230	144.2	34.0	224	0.01
13	154.8	37.7	262	150	36.2	252	0.03
14	160.2	42.2	284	154.6	40.6	278	0.02

Table III a. Age, Height and PEFR in boys in accordance to Tanner staging

	Boys			Boys		
	Pubic hair			Penile development		
Stage	**Age**	**Height**	**PEFR**	**Age**	**Height**	**PEFR**
Stage 1	10.2	140.0	220	10.1	139.9	218
Stage 2	12.4	148.6	260	11.6	144.5	254
Stage 3	13.0	154.6	300	12.6	150.8	284
Stage 4	15.8	166.4	364	15.4	164.2	356
Stage 5	16.2	170.2	380	16.0	161.2	372

Table III b. Age, Height and PEFR in girls in accordance to Tanner staging

	Girls			Girls		
	Pubic hair			Breast development		
Stage	Age	Height	PEFR	Age	Height	PEFR
Stage 1	9.2	132.0	188	9.1	130.9	190
Stage 2	11.5	142.6	192	11.6	141.5	194
Stage 3	12.4	150.6	246	12.2	151.2	244
Stage 4	14.6	161.2	258	14.7	160.4	256
Stage 5	15.2	163.1	278	15.4	162.6	272

DISCUSSION

To interpret the significance of peak expiratory flow measurements, a comparison is made to reference (normal, predicted) values based on measurements taken from the general population. Various reference values have been published in the literature and vary by population, ethnic group, age, sex, height and weight of the patient.[6] The present study was conducted to correlate anthropometric measurements with PEFR in study population.

In this study, we included equal number of boys (260) and girls (260) with no statistical difference in both genders. In this study we analyzed height, weight and PEFR in boys and girls. We found that there was significant difference in height, weight and PEFR in all age groups with
all parameters higher in boys as compared to girls. This is in accordance to Lin et al.[7]

Table III shows Tanner pubertal staging and the mean age, height and PEFR for each pubertal stage in boys (a) and girls (b). Girls achieved pubertal changes at younger age when compared to boys. When the difference of PEFR between the stages of the same sex was analyzed, the increase at each stage was statistically significant ($P<0.05$) in boys and girls.

The pubertal staging correlated well with height and therefore it may indirectly be represented through height. Neve et al[8] reported that the girls' lung development is completed at menarche. The present study did not record the age at menarche because we considered that the menarche is incidental depending on the cyclical hormonal secretions resulting in significant development and disintegration of endometrium and it can occur at any time during puberty.

The measurement of peak expiratory flow was pioneered by Martin Wright, who produced the first meter specifically designed to measure this index of lung function. Since the original design of instrument was introduced in the late 1950s, and the subsequent development of a more portable, lower cost version, other designs and copies have become available across the world.[9]

Peak flow readings are often classified into 3 zones of measurement according to the American Lung Association; green, yellow, and red. Doctors and health practitioners can develop an asthma management plan based on the green-yellow-red zones.

CONCLUSION

Girls acquired pubertal changes at younger at as compared to boys. Age, height and weight can be considered for estimation of PEFR in children.

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