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Study of Correlation of Peak Expiratory Flow Rate with Age, Height, Body Surface Area and Arm Span Of Adolescent Subjects of Garhwal

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ABSTRACT

The Peak Expiratory Flow Rate(PEFR) is accepted as a useful test of ventilatory capacity. It is well documented that ventilatory functions, especially PEFR vary and are affected by age, sex, height, weight, body surface area, arm span, geographical region, physical activity, diurnal variations, environmental conditions, occupation and socioeconomic status of the person. This study was designed to evaluate the correlationship of peak expiratory flow rate with age, height, body surface area and arm span of adolescent subjects of Garhwal. One hundred (100) asymptomatic male adolescents and one hundred (100) asymptomatic female adolescents of 11 to 18 years of age volunteered in this study. Anthropometric measurements including height, weight, BMI, arm span and body surface area were taken. Peak Expiratory Flow Rate was measured directly by using Ferraris Pocket Flow Meter (UK) having a range of 60-700 lit/min.In male subjects correlation of peak expiratory flow rate with age, height, weight, body surface area and arm span was 0.9371 ($p<0.001$), 0.8343 ($p<0.001$), 0.8200 ($p<0.001$), 0.7733 ($p<0.001$) and 0.8363 ($p<0.001$) and in female subjects correlation of peak expiratory flow rate with age, height, weight, body surface area and armspan was 0.8448 ($p<0.001$), 0.7917 ($p<0.001$), 0.7414 ($p<0.001$), 0.8448 ($p<0.001$) and 0.8067 ($p<0.001$). Peak expiratory flow rate shows positive correlation with height, weight, body surface area and arm span in both male and female adolescent subjects of Garhwal.

Keywords: Peak expiratory flow rate, Body surface area, arm span, adolescents

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INTRODUCTION

A large number of physiological tests are required for the assessment of events in respiration and functional status of the lungs [1]. Respirometry has become a basic physiological evaluation for the patients with respiratory illness. Since, as early as 1940s Peak Expiratory Flow Rate (PEFR) and Forced Expiratory Volume in the first second (FEV_1) have been used to evaluate the degree of airway obstruction [2]. The Peak Expiratory Flow Rate has received general acceptance as a useful test of ventilatory capacity. It measures how fast a person can exhale using his/her greatest effort thus it is regarded as a basic physiological parameter for the diagnosis, follow up and treatment of patient with respiratory illnesses such as asthma, chronic bronchitis and emphysema. It can be measured by using Wright's Peak Flow Meter. It takes very short time to perform and does not require electrical power to operate, therefore, can be effectively used in epidemiological surveys as well, especially in rural areas [3]. It is well documented that ventilatory functions, especially PEFR vary and are affected by age, sex, height, weight, body surface area, arm span, geographical region, physical activity, circadian rhythm (diurnal variations), environmental conditions, occupation and socioeconomic status of the person [4-14]. Variation of PEFR in relation to age reveals that there is a steep rise in PEFR from 6 to 18 years of age, thereafter the attained values remain same upto 19 to 26 years and finally are followed by a gradual decline in PEFR from 27 to 58 years [4, 6, 15]. The present study investigates the correlationship of peak expiratory flow rate with age, height, body surface area and armspan of adolescent subjects of Garhwal region.

MATERIALS AND METHODS

The present study was undertaken in the Department of Physiology at a medical college of North India. One hundred (100) asymptomatic male adolescents and one hundred (100) asymptomatic female adolescents of 11 to 18 years of age volunteered for this study. The criterias of selection of the subject were as below that he should be:

1. Physically or mentally fit.
2. A non-smoker.
3. Free from any respiratory or cardiac disease.
4. Co-operative and capable of understanding the procedure.
5. A resident of Garhwal (Uttarakhand) for more than 10 years and staying at least at an altitude of 1000 to 2500 feet or above.
6. Not suffering from any disease that could affect the lung functions, such as general debility and neuromuscular disorders.

The adolescent subjects selected were students of different schools, medical students and healthy relatives of patients admitted in the hospital. Consideration of age, height and weight were kept in mind, while selecting the subjects for the study. A careful detailed parental history of hypertension, diabetes mellitus and obesity was recorded. Informed consent of each subject was taken.

The following anthropomorphic parameters were recorded and pulmonary function was assessed

A. Anthropomorphic parameters

1. Age – It was calculated in years to the nearest birthday.
2. Height – Standing height in centimeters without shoes.
3. Arm span – It was taken as the distance in centimeters, between the tips of middle fingers of both outstretched hands in standing position.
4. Weight – It was recorded in kilograms by asking the subject to stand erect on the weighing machine (Crown) without shoes.
5. Body surface area – It was calculated from Dubois body surface chart prepared by Boothby and Sandiford of Mayo clinic, by approximating the two points i.e. weight in kgs and height in centimeters.

B. Parameter used for pulmonary function assessment

Peak Expiratory Flow Rate (PEFR)

Peak Expiratory Flow Rate was measured directly by using Ferraris Pocket Flow Meter (UK) having a range of 60-700 lit/min. All the subjects were explained the purpose of the test and the method of testing were demonstrated. All efforts were made to allay apprehension and promote co-operation from the subject.

Procedure – The subject was asked to take a deep inspiration with maximum effort and then was instructed to blow out forcefully through the cleaned mouth piece into the instrument. The test was performed in standing position with nose clip in position. After one or two practice trials, the highest of three test readings was taken as the final reading and expressed in liters/min. Test was performed in morning hours to avoid effect of diurnal variation. Data collected was subjected to standard statistical analysis using Microsoft Excel Software.

OBSERVATIONS AND RESULTS

Out of total 200 subjects, 100 were males and 100 were females. These male and female adolescents were further subdivided into four groups according to their age as given in Table 1.

Table 1: Age wise Distribution of Adolescent subjects (n=200)

Groups	Age(years)	Adolescents		Total
		Male	Female	
I	11-12	25	25	50
II	13-14	25	25	50
III	15-16	25	25	50
IV	17-18	25	25	50

The mean and standard deviation of age, height, weight, body surface area and armspan, of all adolescent subjects, male adolescents and female adolescents are given in Table 2.

Table 2: Anthropomorphic parameters of adolescents

Subjects	Age (yrs)	Height (cms)	Weight (kgs)	BSA (m^2)	Armspan (cms)
All Adolescents (n =200)	14.53 ± 2.27	155.54 ± 10.13	43.64 ± 10.92	1.38 ± 0.20	156.37 ± 10.73
Male Adolescents (n =100)	14.43 ± 2.22	157.44 ± 11.10	45.25 ± 12.51	1.42 ± 0.23	159.22 ± 11.60
Female Adolescents (n =100)	14.43 ± 2.22	153.65 ± 8.71	42.05 ± 8.84	1.35 ± 0.16	154.04 ± 9.13

It was observed that all anthropomorphic parameters were higher in male adolescents than in female adolescents.

Anthropomorphic parameters of male adolescents of different age groups is given in table 3.

Table 3: Anthropometric parameters of male adolescents

Group	n	Age (yrs)	Height (cms)	Weight (kgs)	BSA (m^2)	Armspan (cms)
I	25	11-12	143.76 ± 6.56	33.16 ± 6.74	1.17 ± 0.12	144.8 ± 8.30
II	25	13-14	151.44 ± 7.23	37.32 ± 5.73	1.26 ± 0.12	153.28 ± 9.06
III	25	15-16	161.6 ± 4.70	44.92 ± 4.58	1.45 ± 0.11	161.16 ± 6.69
IV	25	17-18	170.52 ± 5.49	61.72 ± 9.58	1.70 ± 0.13	173.16 ± 5.34

It was observed that all anthropomorphic parameters were increasing as the age increases i.e. all values were lowest in group I (11-12 yrs) and highest in group IV (17-18 yrs).

Anthropomorphic parameters of male adolescents of different age groups is given in table 4.

Table 4 : Anthropomorphic parameters of female adolescents

Group	n	Age (yrs)	Height (cms)	Weight (kgs)	BSA (m^2)	Armspan (cms)
I	25	11-12	146.2 ± 5.56	37 ± 19.14	1.23 ± 0.16	149.28 ± 6.20
II	25	13-14	156.4 ± 6.39	41.08 ± 6.01	1.33 ± 0.11	153.24 ± 7.69
III	25	15-16	157.32 ± 6.18	42.76 ± 4.75	1.38 ± 0.10	155.44 ± 7.51
IV	25	17-18	160.88 ± 4.44	51.2 ± 6.87	1.52 ± 0.09	160.68 ± 4.61

In female adolescents also, all anthropomorphic parameters were increasing with age, as seen in male adolescents.

Table 5: Correlation of PEFR with Anthropomorphic Parameters

Parameter	Male		Female	
	Correlation of physical parameters with PEFR (r value)	P - value	Correlation of physical parameters with PEFR (r value)	P - value
PEFR - Age	0.9371	< 0.001	0.8448	< 0.001
PEFR - Height	0.8343	< 0.001	0.7917	< 0.001
PEFR - Weight	0.8200	< 0.001	0.7414	< 0.001
PEFR - Body Surface Area	0.7733	< 0.001	0.8448	< 0.001
PEFR - Armspan	0.8363	< 0.001	0.8067	< 0.001

Correlation of Peak Expiratory Flow Rate with Anthropomorphic parameters (Table 5)

In male subjects

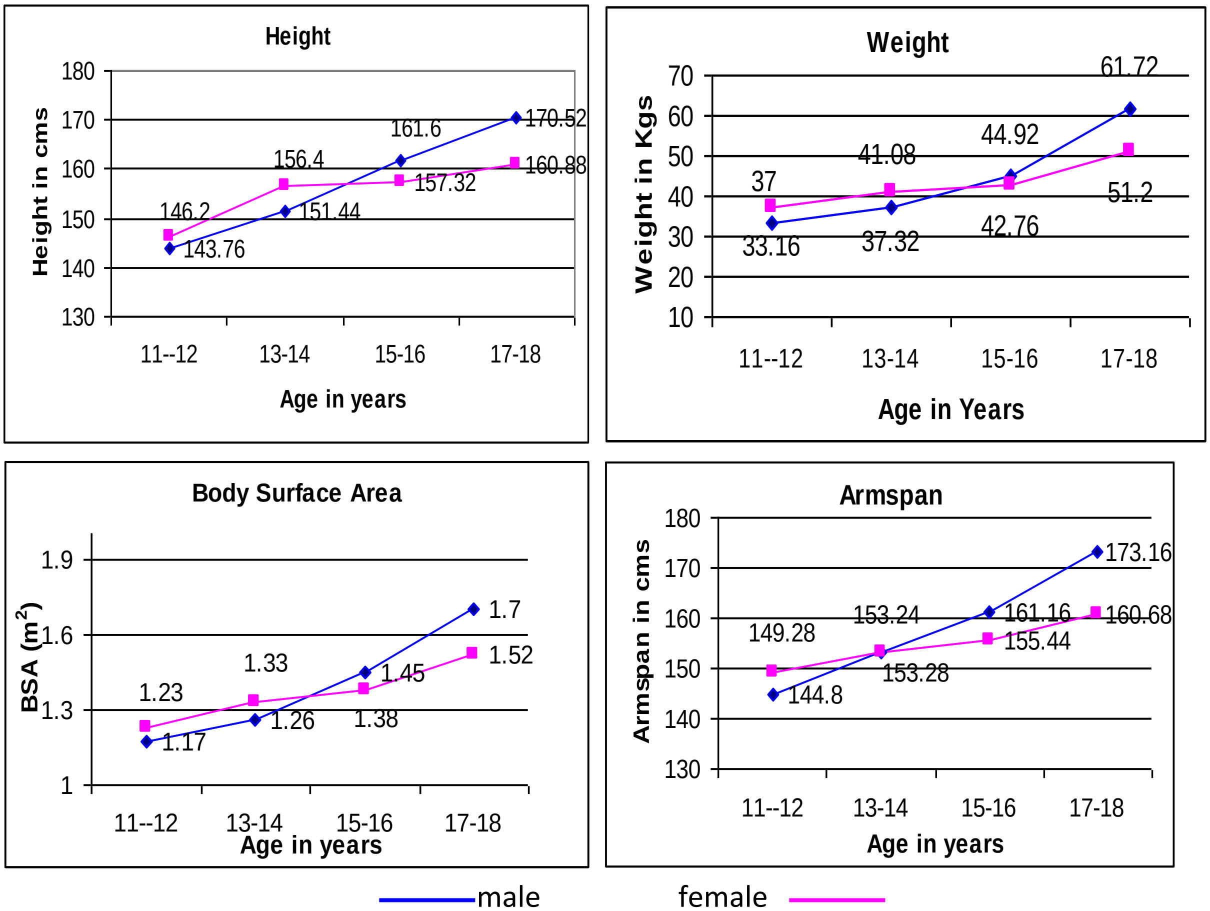
Correlation of peak expiratory flow rate with age, height, weight, body surface area and arm span was 0.9371 ($p<0.001$), 0.8343 ($p<0.001$), 0.8200 ($p<0.001$), 0.7733 ($p<0.001$) and 0.8363 ($p<0.001$).

In female subjects

Correlation of peak expiratory flow rate with age, height, weight, body surface area and arm span was 0.8448 ($p<0.001$), 0.7917 ($p<0.001$), 0.7414 ($p<0.001$), 0.8448 ($p<0.001$) and 0.8067 ($p<0.001$).

It is evident that correlation of PEFR with all anthropomorphic parameters understudy was statistically significant in both male and female subjects.

Figure 1: Anthropomorphic parameters vary with age



DISCUSSION

The observation of present study denoted that PEFR values increase with age (11-18 yrs) in all 200 subjects of both sexes. The correlation between PEFR and age was statistically significant in both male and female subjects. The steep rise in PEFR was present from 16-18 yrs in both sexes. This findings was well on agreement with the earlier studies of Masoud et al [5], Aundhakar et al [13], Mahajan et al [4].

The reason of increased PEFR is basically due to improvement in almost all anthropomorphic parameters with the age as in the present study PEFR shows positive correlation with height ($p<0.001$),weight ($p<0.001$), body surface area ($p<0.001$) and armspan ($p<0.001$) in both male and female subjects. A highly significant positive correlation between arm span and PEFR has been observed in children from 5 to 12 years of age. Expression of correlation of PEFR with arm span can be used more conveniently in subjects or patients in whom height cannot be measured accurately [7].

The age group chosen for the present study belongs to the phase, attaining physical growth appreciably specially due to pubertal spurt. The bones become harder and denser and supported by bulky muscles. On the other side increase fat content of the body contributes to the raise in weight. PEFR being an index of respiratory status and physical fitness as most effort dependent pulmonary functions which can be attributed to better muscular power including respiratory muscle(16). Study of Thurlbeck WM [17] explained that both the size of major bronchi and the total number(but not size) of alveoli in the lung were directly related to stature. Taller people have longer conducting airways than shorter subjects and that these longer airways must serve greater numbers of similarly sized alveoli.

CONCLUSIONS

It is evident that correlation of PEFR with all anthropomorphic parameters understudy was statistically significant in both male and female subjects which concluded that PEFR shows positive correlation with height, weight, body surface area and armspan in both male and female adolescent subjects of Garhwal.

REFERENCES

1. Aggarwal KK. Indian J Clinical Practice 2003; 13:39-41.
2. Eduardo A, Perez L. Ind Pedat 2001; 16: 89-92.
3. Singh HD, Peri S. Indian J Physiol Pharmacol 1979; 23:315-320.
4. Mahajan KK, Mahajan SK, Maini BK, Srivastava SC. Indian J Physiol Pharmacol 1984; 28:319-325.
5. Masoud SR, Rao GM, Morghan LO. Indian J Physiol Pharmacol 1989; 33:223-227.
6. Japegnam V, Amritharaj G, Damodarswamy S, Madhusudhan Rao V. Indian J Physiol Pharmacol 1996; 40:127-133.
7. Pande AH, Pande SH. Indian J Pedia 1984; 51:541-543.
8. Kashyap S, Puri DS, Bansal SK. Ind Pedia 1992; 29:283-288.
9. Mehrotra PK, Verma N, Tiwari S, Kumar P. Indian J Physiol Pharmacol 1998; 42:412-416.
10. Mahajan KK, Mahajan SK, Maini BK. Indian Med Gaz 1985; xix: 76-78.
11. Ambadekar NN, Kandait DW, Vasudeo ND. Indian J Physiol Pharmacol 1999; 43: 393-397.
12. Malik SK, Jindal SK, Bagga N, Bansal S Ind J Med Res 1980; 71:322-324.
13. Aundhakar CD, Kasliwal GK, Yajurvedi VS, Rawat MS, Ganeriwal SK, Sangam RN. Indian J Physiol Pharmacol 1985; 29:14-20.
14. Schwartz J, Katz SA, Fegley RW, Tockman MS. Am Rev Respir Dis 1988; 138:1415-1421.
15. Gupta P, Gupta S, Ajmera RL. Indian J Physiol Pharmacol 1979; 23:08-14
16. Steinberg, Lawrence. Beyond the classroom: why school reform has failed and what parents need to do. 1996; New York: Simon & Schuster (ERIC Document No. ED 398346).
17. Thurlbeck WM. Am Rev Respir Dis 1975; 111:803-844.