A Study of Pulmonary Function: 'Children versus Young Adults' in Guntur, Andhra Pradesh, INDIA.

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Research Article

Abstract: **Introduction**: Pulmonary Function Tests are used to measure baseline status of respiratory function, to monitor treatment and to estimate prognosis. The present study was aimed to determine pulmonary function tests values and to compare the different parameters like FVC, FEV_1, ERV, $FEF_{25-75\%}$, PEFR in children and young adults. **Materials and Methods:** A cross sectional study was conducted to determine the pulmonary function tests in selected children and young adults, belonging to rural area of Guntur district. Fifty male subjects were considered for the study and divided them into two groups basing on the age. Pulmonary function tests were done with the help of Computerized Spirometer. Different parameters like FVC, FEV_1, ERV, $FEF_{25-75\%}$ and PEFR were recorded. **Results and Discussion:** Increase of FVC of 153.49%, FEV_1 of 133.33%, $FEF_{25-75\%}$ of 80.54%, ERV of 84.78% and PEFR of 94.35% was observed in young adults, when compared to children. Statistical significance was obtained by using t test ($P<0.001$). Among the parameters studied, FVC and FEV_1 showed a greater increase in young adults than the remaining parameters, when compared with children. **Conclusion:** In the current study, pulmonary function test values of children and young adults, a marked increase was observed in all the five parameters, from childhood to adulthood as per the body needs of oxygen. It is important to understand the improvement of pulmonary function test values with age among young adults, in interpretation of pulmonary function variations in different physiological and pathological settings.

Keywords: Children, Pulmonary Function Tests, Spirometry, Young adults.

Introduction

In our previous study, we have compared the pulmonary function in children and adolescents. [(1)] The present study was aimed to determine Pulmonary Function Tests values in children (8-12 yrs) and young adults (24-28 yrs), belonging to rural area of Guntur district and to compare the different parameters like FVC, FEV_1, ERV, $FEF_{25-75\%}$ and PEFR. Several studies on lung functions were carried out in children of different age groups in different parts of India.[(2-7)] Individual values vary with subject's age, sex, height and race.[(8)] These tests are used to measure baseline status, to monitor treatment and to estimate prognosis.[(9)] Spirometry is a simple bedside test that can provide great insight into significant respiratory impairment.[(10)]

Materials and Methods

A cross sectional study was conducted to determine the pulmonary function tests in selected children and young adults, belonging to rural area of Guntur district. Fifty male subjects were considered for the study and divided them into two groups (children with age 8 to 12 years and young adults with age 24 to 28 years) who are in good health and without any signs and symptoms of disease. The purpose and objectives of the study were explained to the subjects and parents and their consent was obtained. Age was taken as completed years as per the school records. The height and weight were measured by using height and weight scale. The heights were measured to nearest mm. Weight was measured with minimal clothing to the nearest 100 g. Body surface area (BSA) was calculated from height and weight. Pulmonary function tests were done with the help of Computerized Spirometer P.K.MORGAN Model No. SPIRO-TM-232.[(11,12)] Each boy was explained and demonstrated the technique of the lung function test and was given three trials prior to the actual measurement. Different parameters like FVC, FEV_1, ERV, $FEF_{25-75\%}$, and PEFR were recorded. Considerable physical effort and attentiveness are required for accurate results. Reproducibility of several test attempts (at least three and the best value was recorded as the test result) is important and is a criterion for valid interpretation of test results.[(11,12)] Subjects with medical problems like pulmonary congestion, coughing, thyroid dysfunction, neurologic illness, poor nutrition and corticosteroid-associated muscle weakness were excluded from the study, as they can confuse spirometric testing.[(9)]

Definitions

1. Forced vital capacity (FVC): Maximum volume of air exhaled from the lungs after a maximum inspiration.
2. Forced expiratory volume in one second (FEV_1): Volume exhaled during the first second of an FVC manoeuvre.[(13)]

3. Forced expiratory flow (FEF_{25-75}): Mean rate of airflow over the middle half of the FVC between 25% and 75% of FVC.
4. Expiratory reserve volume (ERV): The volume of air that can be expired with a maximum expiratory effort after passive expiration.[14]
5. Peak expiratory flow rate (PEFR): Maximum velocity with which air is forced out of the lungs.[15]

Results and Discussion

Mean and standard deviation values for age, weight, height & body surface area of children and young adults were shown in Table 1.

Table1: Age, Weight, Height & Body surface area comparison between children and young adults.

	Children (8-12 yrs)	**Young adults (24-28 yrs)**
	Mean ±SD	**Mean± SD**
Age (years)	10.12±1.26	25.76±1.56
Weight (Kgs)	27.44±4.06	71.28±4.20
Hight (cm)	132.92±7.60	174.4±3.05
Body surface area (m^2)	1.03±0.10	1.86±0.06

The mean forced vital capacity (FVC) in the children was 1.72 litres when compared with the mean forced vital capacity of young adults, which was 4.36 litres, shown an increase in forced vital capacity of 153.49% in male young adults. The mean forced expiratory volume (FEV_1) in the children was 1.56 litres when compared with the mean forced expiratory volume of young adults which was 3.64 litres, shown an increase of forced expiratory volume of 133.33% in young adults. The mean forced expiratory flow ($FEF_{25-75\%}$) was 2.21 litres/sec in children when compared with the mean forced expiratory flow in young adults which was 3.99 litres/sec. These results shown an increase in mean forced expiratory flow ($FEF_{25-75\%}$) of young adults by 80.54%. The mean expiratory reserve volume (ERV) in the children was 0.92 litres when compared with the mean expiratory reserve volume of male young adults which was 1.70litres .These results shown an increase in expiratory reserve volume by 84.78% in young adults. The mean peak expiratory flow rate (PEFR) in the children was 281.92 L/min when compared with the mean peak expiratory flow rate in the young adults which was 547.92 L/min, showed an increase of 94.35%. Various national and international studies have shown the variability of PEFR with age, sex, height and BMI. [15] In our previous study, pulmonary function test values were comparred in children and adolescents. [1] Increase of FEV_1 of 93.58%, FVC of 105%, ERVof 67.39%, $FEF_{25-75\%}$ of 52.03%, PEFR of 46.19% was observed in adolescents, when compared to children. Chowgule et al did a study on children between age range 6 years to 15 years.[7] The pulmonary function data was separated by sex, and classified on the basis of height and age. The mean and standard deviation was calculated for every such variable. The lung function test variables show a linear positive correlation with height and age. Height explained the maximum variance in lung function parameters. For clinical evaluation of child's lung function, height is the most significant independent parameter in comparison to age and weight. Pande et al conducted a comparative study in 783 children (aged 6-17 years) from a school in urban Delhi and 523 children (aged 6-15 years) from another school in Nellore, Andhra Pradesh.[16] Age, sex, height and weight were independent predictors of PEFR in children from Nellore. Age, sex and height, were independent predictors of PEFR in boys from Delhi while height alone was an independent predictor of PEFR in Delhi girls. Common prediction equations for predicting PEFR in boys and girls have been developed for both regions based on age and height. For the same height and age, boys had higher PEFR than girls. The PEFRs of children from both parts of the country were similar, but were lower than those reported for American white children. Lung function first increases with weight (muscularity effect) and decreases with further increase in weight (obesity effect).[17] Susan R et al did a study on the relationship between longitudinal change in Pulmonary function and Nonspecific airway responsiveness in children and young adults. [18] Data from this suggests that both the degree and variability of airway responsiveness are associated with specific pulmonary function changes. Furthermore, airway hyperresponsiveness may be associated with different effects on airway function and lung size in growing children. Xiaobin W et al investigated the determinants of sex-specific maximally attained levels of FEV_1, VC, and the ratio of FEV_1 to VC, in their study. [19] Subjects were between the ages of 15 and 35 years (1,818 males and 1,732 females), in Netherlands. The presence of respiratory symptoms, increased eosinophils and increased airway responsiveness were all significant predictors of reduced level of FEV_1. To the degree that these factors diminished plateau phase pulmonary function, they may be important predictors of chronic obstructive pulmonary disease in later life. Janet BS, Gerald JB, Arend B did a study on Growth and decay of pulmonary function in healthy blacks and whites. [20] They have computed regression equations for lung function measurements (FVC, $FEV_{1.0}$, $FEV_{1.0}$/FVC, PEF, MEF, 50% and MEF 25%) as a function of age, height and weight terms for eight subgroups, by sex and race, and for children or adults. The regression equations allow more accurate prediction of normal lung function. In addition, the lower 95% confidence limits are closer to

the predicted values and are valid regardless of height, weight and age within each subgroup. Katharine HK et al did a study on ventilatory functions of normal children and young adults in Mexican-American, white and blacks. [21] The best performed forced vital capacity curve of each student was selected by the computer program from which the following measurements were extracted: FVC, FEV_1, FEV_1/FVC ratio, PEFR, and MMEF. Each student also had the peak expiratory flow rate measured by the Wright peak flowmeter to establish normal values with this instrument. Significant differences of lung volume and flow rate exist among the three races, and between male and female subjects. Current study was conducted with an idea to compare the Pulmonary Function Tests in children and young adults of Guntur rural area. Among the parameters recorded in our study, FVC and FEV1 showed a greater increase in young adults than the remaining parameters when compared with children (Table 2). Statistical significance was obtained by t test (P<0.001).

Table 2: Comparison of Pulmonary Function Test values between children and young adults.

Pulmonary Function Tests	Children (8-12 yrs)	Young adults (24-28 yrs)	P value
	Mean ±SD	Mean± SD	
FVC (Lit)	1.72±0.28	4.36±0.18	0.001
FEV_1 (Lit)	1.56±0.23	3.64±0.16	0.001
$FEF_{25-75\%}$ (Lit/sec)	2.21±0.32	3.99±0.15	0.001
ERV (Lit)	0.92±0.10	1.70±0.05	0.001
PEFR (Lit/min)	281.92±42.23	547.92±24.29	0.001

Limitations of the study

1. Only male subjects were included,
2. Spirometric measurements are effort dependent and cannot be done reliably by children.[13]

Conclusion

In our study, Pulmonary function in children versus young adults among rural area of Guntur district there was a marked increase in all the five parameters (FVC, FEV1,ERV, $FEF_{25-75\%}$, and PEFR), from childhood to young adults as per the body needs of oxygen. It is important to understand the improvement of pulmonary function test values with age among young adults, in interpretation of pulmonary function variations in different physiological and pathological settings.

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