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COMPARATIVE STUDY OF PULMONARY FUNCTIONS IN PRE-PUBERTAL AND PUBERTAL GIRLS

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ABSTRACT

Introduction: During pregnancy, increase in alveolar ventilation and luteal phase is also well known and has been attributed to increased levels of progesterone. The study has reported pulmonary changes in pre-pubertal and pubertal girls.

Methodology: The present cross-sectional study conducted among pre pubertal girls (10-12 yrs) and pubertal girls between age groups 13 to 18 yrs. Standard anthropometric measurements weight (kg), height (cm), was measured in a beam balance. Details history and minimum three readings were given and best of the three was chosen for analysis, based on standardization of spirometry study based on ATS/ERS task force series and various other studies.

Result: mean age of the participants was 11.36 (±0.69) years in pre-pubertal girl and 15.3(±2.04) years in pubertal girls. Similarly mean height, weight, BMI (Body Mass Index) and BSA (Body Surface Area) was 134.8(±8.91) cm, 28(±5.9) kg, 15.29(±2.02) (Kg/m^2), and 1.02(±0.13) (m^2) in pre-pubertal girl and 153.13 (±9.77) cm, 39.44 (±7.27) kg, 16.67 (±1.95) (Kg/m^2), and 1.29 (±0.15) (m^2) in pubertal girl respectively. There were difference between respiratory parameters during luteal and follicular phase of menstrual cycle in pubertal girls but this difference was found statistical significant only with FEV1/FVC (%).

Conclusion: Respiratory parameters during phases of sexual cycle in pubertal girls, the results of which shows slight changes and difference was statistically not significant except FEV1/FVC (%).

Key words: Pulmonary function, puberty, BSA, BMI

INTRODUCTION

The period of transition from infancy to adulthood, called "growing up" does not only change in the child's size but in her basic physiology and anatomy, which alter the structure of both brain and body.

Studies suggest that the lung functions exhibit diurnal variation as well as show changes dependent on different phases of the menstrual cycle. During pregnancy, increase in alveolar ventilation and luteal phase is also well known and has been attributed to increased levels of progesterone.[1, 2, 3] Such a comparative study has hereby been carried out and research data and review of literature has rarely available.

Studies have shown that progesterone also causes an increase III diffusion capacity[4] mouth occlusion pressures[5] and changes at central and peripheral level in the carbon dioxide sensitivity during the normal menstrual cycle. Also in females the

regular adult hormonal pattern is reached after few' cycles following menarche, which may vary up to two years.[6] During such period the cycles are anovulatory. The study has reported pulmonary changes in pre-pubertal and pubertal girls.

The present study was carried out to find out the respiratory changes in pre pubertal and pubertal girls.

METHOD

The present cross-sectional study was conducted among normal healthy pre pubertal girl and pubertal girl in Vadodara region. The study was approved by ethical committee of Government Medical College, Vadodara. The prior permission respected authorities was taken and written consent from the parents or guardian of the participants involved in the study was obtained. The study was conducted among pre pubertal girls (10-12 yrs) and pubertal girls between age groups 13 to 18 yrs. All girls were included in this age group except those having history of (h/o) fever last14 days, respiratory illness like symptoms in last14 days, acute or chronic respiratory diseases, history of cardiac or renal problems, anaemia like symptoms, history of any drug intake which can affect lung function, allergic history, history of deformity of bone, chest or spine and any muscular weakness, significant family history of asthma, atopy, or other chronic lung diseases.

Details regarding purpose and objective of the study were explained to parents and school authorities. Data was collected by asking, and a thorough clinical examination on each girl was done to rule out any significant problems fitting the exclusion criteria. A total of 90 girls, 45 pre-pubertal and 45 pubertal girls were included in the study while remaining girls were excluded according to exclusion criteria.

Standard anthropometric measurements weight (kg), height (cm), was measured in a beam balance. Details history including name, age, socioeconomical status, physical activity, any past/ family history, with its regularity or irregularity, duration, age of menarche, painful, clots, LMP, was taken properly in pubertal girls.

All included subjects were tested in a proper sitting position with the head straight. Before testing, the procedure was explained and demonstrated to each until full familiarity was achieved. Minimum three readings were given and best of the three was chosen for analysis, based on standardization of spirometry study based on ATS/ERS task force series [8] and various other studies.[2-5,7] Each participant was told to take a deep breath and then blow into the mouth piece as hard and fast as she could. The same spirometer was used throughout the study and the tests were performed by the same technician. Data were collected and analysis was done with appropriate statistical test.

RESULTS

Table 1: Anthropological data of the subjects (n=90)

Variables	Pre pubertal girl (n=45)	Pubertal girl (n=45)
Age (Yrs)	11.26 ± 0.69	15.3 ± 2.04
Height (cm)	134.8 ± 8.91	153.13 ± 9.77
Weight (Kg)	28 ± 5.9	39.44 ± 7.27
BMI (Kg/m²)	15.29 ± 2.02	16.67 ± 1.95
BSA (m²)	1.02 ± 0.13	1.29 ± 0.15

Values are in Mean ± SD

Table 2: Respiratory parameters in study participants (n=90)

Parameters	Pre pubertal girl (n=45)	Pubertal girl (n=45)	P value
FEV1 (Obs.)	1.64 ± 0.33	2.4 ± 0.48	0.014*
FEV1 (%)	78.02 ± 13.51	104.6 ± 20.06	0.010*
FVC (Obs.)	1.67 ± 0.41	2.7 ± 0.53	0.092
FVC (%)	78.22 ± 19.4	108.8 ± 20.35	0.752
FEV1/FVC (Obs.)	90.87 ± 9.24	89.73 ± 10.03	0.588
FEV1/FVC (%)	93.15 ± 10.01	96.66 ± 11.13	0.484
PEFR (Obs.)	3.29 ± 0.74	4.71 ± 1.4	<0.001*
PEFR (%)	75.8 ± 13.9	94.81 ± 28.07	<0.001*
MVV (Obs.)	91.23 ± 15.53	121.7 ± 19.34	0.149
MVV (%)	80.95 ± 18.78	112.9 ± 26.93	0.018*

Values are in Mean ± SD; *Statistically significant (P <0.05)

Table 3: Association between respiratory parameters in luteal and follicular phases of menstrual cycle in pubertal subjects (n=27)

Parameters	Luteal Phase	Follicular Phase	P value
FEV1 (L)	2.50 ± 0.44	2.36 ± 0.49	0.587
FVC (L)	2.81 ± 0.42	2.84 ± 0.41	0.903
FEV1/FVC (%)	88.16 ± 10.77	91.67 ± 5.89	0.003*
PEFR (%)	4.87 ± 1.22	4.67 ± 1.37	0.558
MVV (%)	92.91 ± 18.02	101.05 ± 19.9	0.616

Values are in Mean ± SD; *Statistically significant (P value <0.05)

According to table 1, mean age of the participants was 11.36 (±0.69) years in pre-pubertal girl and

15.3(±2.04) years in pubertal girls. Similarly mean height, weight, BMI and BSA was 134.8(±8.91) cm, 28(±5.9) kg, 15.29(±2.02) (Kg/m^2), and 1.02(±0.13) (m^2) in pre-pubertal girl and 153.13 (±9.77) cm, 39.44 (±7.27) kg, 16.67 (±1.95) (Kg/m^2), and 1.29 (±0.15) (m^2) in pubertal girl respectively.

According to Table 2, mean of the various respiratory parameters like FEV1, FVC, FEV1/FVC, PEFR and MVV were 1.64(±0.33), 1.67(±0.41), 90.87(±9.24), 3.29(±0.74) and 91.23(±15.53) in pre-pubertal girls and 2.4 (±0.48), 2.7 (±0.53), 89.73 (±10.03), 4.71 (±1.4) and 121.7 (±26.93) in pubertal girls respectively. FEV1 and PEFR was found statistical significant.

According to table 3, there were difference between respiratory parameters during luteal and follicular phase of menstrual cycle in pubertal girls but this difference was found statistical significant only with FEV1/FVC (%).

DISCUSSION

In present study attempt had been made to find out the changes, which occur during the pubertal periods in girls. Hence two group of subjects were selected viz. Girl with the age group of 10 -12 years while the other group was with the age group of 13-18 years.

In India several studies were carried out on school children to predict ventilatory functions using different anthropometrical variables. In the present study we tried to carry out the pulmonary function tests in children particularly in girls of two different age groups. The first group of girls who are in the phase of puberty and the other group of girls was of the age crossed the puberty phase (adolescent).

A study carried out by Bhattacharya and Banerjee (1966)[7] reported that height had shown the best relationship with vital capacity in both the sexes. It was reported that the VC increases with increase in standing height. Sharma et al (1997)[8] reported- regression, equations for prediction of ventilatory function using age, height and weight as independent variables. Raju et al (2004)[9] conducted a study to evaluate pulmonary function that develops prediction equations in Indian girls for height, weight, sitting height and chest circumference and body surface area. They concluded that variables like height, fat free mass and chest circumference or age have shown very strong predictability for FEVI, FVC and PEFR.

Several researchers have shown that the ventilator parameters like FVC, FEV1, PEFR etc increase in accordance of age, height, chest circumference, and fat free mass. In the present study though we did not try to find out the prediction equation for the respiratory parameters in relation to age, height, weight, BSA, BMI, etc. the study shows increase in the values of FVC (1.67 ± 0.41 and 2.70 ±0.53 litres), FEV1 (1.64 ±0.33 and 2.40 ±.48 litres), and, FEF25-75% (2.25 ± 0.63 and 3.31±1.08 litres/min), PEFR (3.29 ± 0.71 and 4.71 ± l.40litres/min), and decrease in the values of MVV (121.70 ± 15.53 and 91.23±19.34 litres/min) while FEVI% had no significant changes(in upper age group (pubertal group 13 – 17 years) when compared with lower age group (pre-pubertal group 10 - 12 years).

With the advancing age there is increase in height (134.80± 8.91 and 153.13 ± 9.77 cm), weight (28.00 ± 5.90 and 39.4 ± 7.27 kg), BMI (15.29 ±2.02 and 16.67 ± 1.95 kg.m2) and BSA (1 .02 ± 0.13 and 1 .29 ± 0.15 m2) when comparison was made between the groups (Table - 1) with which there occurs changes in the values for respiratory parameters (Table - 2). Rajkapoor and Mahajan (1997) [10] also reported in their study on ventilatory function in school children of 6 - 13 years that different ventilatory functions have been derived with the best combination of physical parameters. Aundhakar et al (1985) [11] established a positive correlation between pulmonary function like FVC, MVV, PEFR and anthropometric parameters like height, weight and body surface area.

In the present study we also attempted to find out changes in respiratory functions in different phases of menstrual cycle in menstruating girls (II group with the age group of 13 - 18 years of age-Menarche). In the present study respiratory parameters during luteal phase and follicular phase of menstrual cycle did not show any significant changes except FEV1/FVC (%).

The present study also showed changes either increase (FVC, FEVI/FVC) or decrease (FEV1, FEF25-75%, PEFR and MVV) in respiratory parameters during menstrual cycle, but when compared statistically there were no significant differences.

CONCLUSION

Respiratory parameters like FEV1, PEFR and MVV was found significant difference statistically

when compared between two groups. Respiratory parameters during phases of sexual cycle in pubertal girls, the results of which shows slight changes and difference was statistically not significant except FEV1/FVC (%). With increase age there is increase in height, weight, BMI and BSA as well as values for respiratory parameters.

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