Gender variation in Lung function parameters in Indian Adolescents

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1. Introduction

Pulmonary function test parameters are important in assessment of the lung function[1]. This is the best diagnostic aid in the assessment of obstructive and restrictive diseases of the respiratory tract with little prognostic significance. All the studies in the literature to define the baseline pulmonary functions have been done in the western population with few been done in Indian population. The results of PFT can be influenced by a variety of factors including age, lean body mass, race, age, sex, height, weight, BMI and socioeconomic factors. The present study was undertaken to assess the gender difference in Lung function values like FVC, FEV1, FEV1% and MVV in Indian adolescent males and females of age group 13 to 19 years. 300 healthy students were included in study. Males and females were stratified into age groups 13 to 15, 15 to 17, 17 to 19 years. They were subjected to Pulmonary function test using MEDSPIROR. The PFT parameters FVC, FEV1, FEV1%, MVV were compared in males and females. Statistical analysis was done with SPSS software. It was observed PFT parameters were significantly more in males as compared to females (P value<0.05) except FEV1 was more in females as compared to males in age group 17 to 19 years, but it was statistically insignificant (P value>0.05). The lung function values are more in males as compared to females probably because males have larger lung and muscularity than females. Study intended to show gender difference in certain lung function parameters.

2. Material and Methods

The cross sectional study was conducted in over 300 students of age groups 13 to 19 years. There was 155 males and 145 females. They were stratified in age groups (A) 13-15 Years (B) 15-17 Years © 17-19 Years

The school that was selected had students from low and middle socioeconomic group. All volunteers were subjected to general and systemic examination. Detail history was obtained. Only students who were physically healthy without any signs and symptoms were included in study. The experimental protocol was explained to all students and written informed consent was obtained from parents. Permission was taken from principal of school/junior college. The institutional ethical committee approved the study. Procedure for PFT was explained to students. PFT was carried out in comfortable sitting position and subject were encouraged to perform the test to their optimum level. Day to day calibration of medspiror machine was done regularly.

Inclusion criteria:

1) All subjects in study were from age group 13 to 19 years.
2) Both males and females were included.
3) Nonsmokers.
4) No history of COPD, asthma.
5) No structural deformities of thoracic cage.

FVC, FEV1, FEV1%, MVV were PFT parameters which were used.

Statistical analysis

Student’s t test was used to compare PFT values between males and females. The probability less than 0.05 was considered statistically significant. All calculation were done with help of SPSS version 10.02.
3) Results:

Study was conducted in 300 subjects (155 males and 145 females) of age groups 13 to 19 years. Age is most important factor for PFT parameters. Number of males and females in each age is shown in table 1. All students were stratified into age groups A, B, C. All parameters FVC, FEV1, FEV1%, MVV were compared in males and females.[4]

- It was found that all parameters under study were significantly higher in males (Table 2). P value <0.05.
- FVC values are higher in males and are significant, P value <0.05 (Table 2, 3).
- FEV1 values are higher in males and significant, P value <0.05 except in group C (Table 3).
- FEV1% values are higher in males except in group C (Table 2, 3).
- MVV values are higher in males in group A & B except group C and are significant P value <0.05 (Table 2, 3).
- Higher FEV1, FEV1%, MVV values in C group females shows no statistical significance.

All above results are illustrated in bar diagram 1 to 4.

Table 1.- Age wise and sex wise distribution of study population

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number of Males</th>
<th>Number of Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td>14</td>
<td>28</td>
<td>47</td>
</tr>
<tr>
<td>15</td>
<td>51</td>
<td>34</td>
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<tr>
<td>16</td>
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<td>25</td>
</tr>
<tr>
<td>17</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2.- Pulmonary function tests in male and female Groups of the study population (mean value)

<table>
<thead>
<tr>
<th>PFT Parameter</th>
<th>Male</th>
<th>Female</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC (Litres)</td>
<td>1.81 ± 0.61</td>
<td>1.37 ± 0.41</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>FEV1 (Litres/sec)</td>
<td>1.41 ± 0.69</td>
<td>0.97 ± 0.51</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>FEV1%</td>
<td>79.91 ± 27.83</td>
<td>73.53 ± 23.65</td>
<td>0.0338*</td>
</tr>
<tr>
<td>MVV (Litres/min)</td>
<td>61.09 ± 20.30</td>
<td>48.76 ± 16.30</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

*P value <0.05 – Highly significant.

Table 3.- Age wise distribution of PFT values (mean) in Males and Females.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>FVC</th>
<th>FEV1</th>
<th>MVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-15 years</td>
<td>1.3055</td>
<td>1.0027</td>
<td>58.8947</td>
</tr>
<tr>
<td>15-17 years</td>
<td>1.2908</td>
<td>0.9528</td>
<td>59.4339</td>
</tr>
<tr>
<td>17-19 years</td>
<td>1.6794</td>
<td>1.0822</td>
<td>64.3322</td>
</tr>
</tbody>
</table>

Table 4.- FEV1 values (Litres/sec) in Males and Females of Age Group 17-19 Years

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Mean FEV1 value</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-19 Years</td>
<td>1.41</td>
<td>0.55</td>
</tr>
</tbody>
</table>

*P value > 0.05 - Not significant.
4. Discussion

Age is most important factor for lung function parameters. Linear positive correlation was obtained for most of PFT parameters with age. Higher values of FEV1, FEV1% and MVV in females of age group C must be due to female sex hormone progesterone. This could be due to the fact that menstrual cycles become regular in females in C group. The progesterone levels in this C group could be factor for more values of FEV1 in females. The fluctuating hormonal level of the menstrual cycle play on broncomotor tone. The fact that progesterone could cause relaxation of smooth muscle of respiratory tract may be seen from study conducted by Beynon et al. The major limitation of our study is smaller sample size in C group.

Higher PFT values in males as compared to females were also observed by Dockery PCW et al [6]. Even when males and females are matched for height, weight males have larger lungs than females. Another contributing factor could be more muscularity in males that account for higher values of PFT.

Sex hormones, sex hormone receptors or intracellular signalling pathways in addition to anatomical and physiological differences may also be responsible for gender difference in lung function values, this was observed by Anugya Behera, Basanta Kumar Behera, Somnath Dash, Soumya Mishra [14]. Higher PFT values in males as compared to females were also observed by Vohra RS [7], Aundhakar CD et al [8]. Malik SK et al [9]. Shrivastava A, Kapor KK, Srivastava KL, Thakur S, Shukla N [10]. Choughale RV [11]. Vijayan VK et al. For this gender dependent lung size variation different normal prediction tables must be used for males and females. Over last several decades much research has been undertaken to standardise the normal values for lung volume and capacities in Indian adolescent population. This study will help to evaluate lung function mandatory before any surgery as pre anaesthetic checkup.

Conclusion:

The PFT parameters studied FVC, FEV1, FEV1%, MVV were significantly higher in males as compared females. Only FEV1 values in females of C group was higher than males values because of the effect of female sex hormone level at this age. Also it was observed that PFT values in males and females were less than the predicted values for the particular age group as the subjects were from corporation schools and undernourished probably due to low socioeconomic status. Linear positive correlation were obtained for most of PFT parameters with age. It is prospective study which will further help to find the standard lung function parameters for Asian population.

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6. References: