ORIGINAL ARTICLE
PREDICTED AND RECORDED VITAL CAPACITY IN STUDENTS OF SHALAMAR MEDICAL AND DENTAL COLLEGE, LAHORE

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Background: The study aimed at observing the difference in predicted and recorded Vital Capacity in young Pakistani adults. Methods: Female students (n=46) and male students (n=30) belonging to age group 18–20 years, height 150–190 Cm, and with no history of smoking or respiratory ailment participated in the study. Predicted Vital Capacity was calculated by using the formula based on age and height. Vital Capacity was recorded on Students’ Spirometer of 9 L capacity. Results: A statistically significant difference between predicted and recorded Vital Capacity (p<0.05) for both female and male medical students was observed. In females, recorded Vital Capacity values were 22% less than predicted values, and in males they were 23% less than the predicted value. Conclusion: Vital Capacity is dependent on other factors besides age and height. Therefore recorded values 77–78% of predicted should be considered normal. The incorporation of weight in prediction equation would result in better estimation of Vital Capacity in Pakistan for different age groups.

Keywords: Predicted vital capacity, spirometer

INTRODUCTION
Vital capacity (VC) is maximal volume of air forcefully expelled from the lungs after a maximal inspiration. Vital Capacity is a critical component of good health. Measurement of VC is useful diagnostically and is an important pulmonary function test.1 Predicted Vital Capacity formulas given by researchers for Caucasian population always overestimated the values for black races.2,3 Lung function tests provide a clearer understanding of pulmonary function in subjects of different races, age, sex, occupation and profession. If there are functional abnormalities in the respiratory system, the deviation from normal can form a basis for diagnosis and assessment of progress in the management of chronic ventilatorydiseases.4 Tests of lung function, of which spirometry is by far the most common, find application in diagnosis, assessment and management of patients with different lung diseases and also as outcome tools in research studies.5 Interpretation of an observed value involves comparison with a reference value, defined as ‘normal’ derived from a representative sample of healthy subjects. Unlike most other measurements in medicine where universally applicable normal ranges are available, lung function shows wide variations even in ‘normals’. Reference equations are used to determine a normal range of spirometry results. The sources of variation in lung function have been summarised by the American Thoracic Society (ATS).1

Besides technical factors related to equipment and procedures, biological and environmental factors are other sources of variation. These include racial and ethnic, sex and anthropometric factors as well as several other factors including environmental influences, nutrition and childhood infections, and other undefined factors. Significant differences are known to exist among the major ethnic groups in the United States. Several prediction equations have been described for northern, eastern, western and southern regions in India. These equations have limitations.6,7

Vital capacity is a measure of the maximum amount of air the lungs can breathe in or out. At rest, values vary from about 3–6 litres, according to age, sex, and height. Measurements of vital capacity are used as part of a fitness assessment. A person whose vital capacity is less than 75% of the expected value, is generally advised to consult a doctor for further testing before exercising. A normal adult has a vital capacity between 3 and 5 litres. After the age of 20 years the vital capacity decreases approximately 250 ml per 10 year.8,9 Spirometry is pivotal in screening, diagnosing and monitoring respiratory disease and is increasingly advocated for use in primary care practice.10 Most pulmonary function laboratories in the USA and Europe use reference values based on populations with predominantly European backgrounds.11

The objective of the present study was to observe the differences in predicted and recorded vital capacity in medical students in age range of 18–20 years.

MATERIAL AND METHODS
Seventy-six (46 female, 30 male) medical students of 1st year MBBS from Shalamar Medical and Dental College, belonging to age group 18–20 years and height ranging from 150–190 Cm having no history of smoking or respiratory ailment consented to participate in the study. Written consent from all subjects was taken after explaining the experimental procedure.
Age in completed years, and standing height in Cm was recorded. Predicted vital capacity was calculated using the following equations:

Males:
\[ VC = (0.052 \times \text{Height in Cm}) - (0.022 \times \text{Age in years}) - 3.6 \]

Females:
\[ VC = (0.041 \times \text{Height in Cm}) - (0.018 \times \text{Age in years}) - 2.69 \]

Vital capacity was recorded by Students’ Wet Spirometer having capacity of 9 litres. The subject sat comfortably facing the spirometer and was asked to inspire as deeply and as fully as possible to fill the lungs. While keeping the nostrils closed with a nose clip and the mouthpiece held firmly between the lips, the subject was instructed to expel all the air with maximum effort into the spirometer. Three acceptable spirometers were taken at intervals of 5 min and the highest among the 3 was taken as final. The spirogram was obtained on a kymograph with drum speed 2.5 mm/Sec. The calculated vital capacities were compared as percentage of predicted values.

SPSS-17 was used for data analysis. The comparison of mean values between predicted and recorded vital capacities were performed by one sample t-test. Correlation between variables was established using one-tailed Pearson correlation.

RESULTS

The results are shown in Tables 1–4 and Figure-3.

There was a statistically significant difference \((p<0.05)\) between predicted and recorded vital capacity in female medical students as shown in Table-1. The recorded vital capacity is 78% of the predicted value.

Table-1: Comparison of predicted and recorded vital capacity in female medical students

<table>
<thead>
<tr>
<th>Predicted VC</th>
<th>Recorded VC</th>
<th>% Predicted</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.39±0.40</td>
<td>2.67±0.42</td>
<td>78</td>
<td>&lt;0.05*</td>
</tr>
</tbody>
</table>

Mean±SD, VC=vital capacity, *significant

Table-2 shows a statistical significant difference between recorded and predicted vital capacity in medical students and the percentage of recorded to predicted vital capacity is 77%.

Table-2: Comparison of predicted and recorded vital capacity in male medical students

<table>
<thead>
<tr>
<th>Predicted VC</th>
<th>Recorded VC</th>
<th>% Predicted</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.65±0.45</td>
<td>3.62±0.58</td>
<td>77</td>
<td>&lt;0.05*</td>
</tr>
</tbody>
</table>

On comparison of age and height with predicted vital capacity both in male and female medical students a statistically significant relation is shown in Table-3 and Table-4 respectively. Highly significant correlation \((r=0.96, p<0.01)\) existed between the height of the female subjects and vital capacity. Linear, regression analysis shows that height is the best predictor for vital capacity.

Table-3: Comparison of age with predicted vital capacity in female and male medical students

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age (Yr)</th>
<th>Predicted VC</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>19.06±0.92</td>
<td>3.50±0.24</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Male</td>
<td>19.5±0.84</td>
<td>4.85±0.30</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Table IV: Comparison of height with predicted vital capacity in female and male medical students

<table>
<thead>
<tr>
<th>Gender</th>
<th>Height (Cm)</th>
<th>Predicted VC</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>159.63±5.7</td>
<td>3.50±0.24</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Male</td>
<td>170.9±5.9</td>
<td>4.85±0.30</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Figure-1: Water-sealed Wedge type Spirometer

Figure-2: Typical Spirogram

Figure-3: Correlation between height and predicted vital capacity in female medical students
DISCUSSION

Over the past 30 years, pulmonary function testing has been put to widespread clinical use and is presently considered an essential prerequisite to diagnose various obstructive and restrictive disorders. Spirometry is the most widely used screening test for lung function or pulmonary function studies. It is usually the first test to be performed and interpreted. Spirometry can be carried out in the ambulatory setting, physician’s office, emergency department or inpatient setting. Our study highlights the importance of obtaining normative values for lung function in medical students and comparing them with the predicted values. Lower results of recorded vital capacity than predicted in male students could be due to lack of correct history of smoking which the students may not have informed due to social stigma. In one study it was observed that smoking in all likelihood modified vital capacity over time but not in recent smokers.

The values we observed are different from those recorded in Caucasians of the same age group. The present study shows a statistically significant relationship between height, predicted and recorded vital capacity in both male and female medical students.

CONCLUSION

Vital Capacity is dependent on other factors besides age and height. Therefore, the recorded values can be considered normal. The incorporation of weight in prediction equation would result in better estimation of Vital Capacity in Pakistan for different age groups.

REFERENCES


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