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A Study of Correlation between Lung Function Test and the Body Surface Area in Healthy Young Adults

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Abstract
Introduction: *One of the most important functions of the lungs is ventilation. The ventilation is effected by different factors such as strength of the respiratory muscle, chest circumference, presence or absence of body fat, height and also the sex of the individuals. The spirometry is one of the most common procedures to measure the ventilatory capacity of the lungs.*
Aims and Objective: *the aim of the present study is to find a correlation between the body surface area and lung volume and capacities.*
Materials and Methods: *the present study was conducted on 200 healthy young adults of 18- 21 years of age in around the Assam Medical College, Dibrugarh. Group I comprised of 120 healthy young males and Group II comprised of 80 healthy young females. TV, IRV, ERV, MVV were measured with Inco's double recording spirometer in conjunction with electric kymograph and PEFR was measure with mini wright peak flow meter.*
Results: *in the present study the study population is devided into two groups on the basis of body surface area (BSA) group 1 BSA of 1.3-1.49 Sq/m and Group 2 1.5-1.69 Sq/m. It has been found that the study population having higher body surface are have higher lung function than the group having lower body surface area, which is also statistically significant.*
BSA body surface area; TV tidal volume; IRV inspiratory reserve volume; ERV expiratory reserve volume; MVV maximum ventilatory volume; PEFR peak expiratory flow rate.

INTRODUCTION

Pulmonary ventilation which means the inflow and outflow of air between the atmosphere and the lung alveoli. Spirometry is one of the simple procedures to measure the ventilatory function of an individual. It has been found that the lung volumes and capacities are affected by many factors one of the most important is body surface area. Body size has a tremendous effect on the PFT values. A small man will have a smaller PFT results than a man of the same age that is much larger. Normal tables account for these variables by giving predicted PFT data for males or females of a certain age and height. Some times as people age increases they begin to increase their body mass by increasing their body fat to lean body mass ratio. If they become too obese the abdominal mass prevent the diaphragm from descending as far as it could and the PFT results will demonstrate smaller measured PFT outcome than expected, i.e. – the observed values are actually smaller than the predicted values. Body surface area depends on height and the weight of the person; Stature (standing height) can be

represented as the sum of leg length and sitting height. As a result, stature and sitting height are correlated. Both are also correlated with all the primary indices of lung function. The correlations are higher for stature than for sitting height, probably because the inclusion of leg length leads to a better representation of body size. In adults through into middle age the mass often continues to increase but at a slower rate. Adults who put on weight usually accumulate fat. However, in persons who undertake physical training, a gain in weight is due to an increased quantity of muscle and mineralisation of bone. The quantity of fat may then be relatively small. In most men, and to a lesser extent in women, a *change* in fat is the largest single cause for a *change* in lung function.

MATERIALS AND METHODS

The study was conducted on 200 healthy young medical students of both sexes in age group of 18-21 years. History was taken from each subject and each subject were clinically examined to exclude apparent cardio-vascular and respiratory disease. The subjects were devided into two groups. Group I comprised of 120 normal healthy young males. Group II comprised of 80 normal healthy young females. The subjects were seated on a high stool keeping his back towards the instrument to minimise psychic effect, and a nose clip was used. The tests were performed at various times of the day, but most were done between 10am to 12noon. The ventilatory tests consisted of the vital capacity (VC), tidal volume (TV), inspiratory reserve volume (IRV), expiratory reserve volume (ERV), and maximum voluntary ventilation (MVV). before doing the tests spirometer was filled with water 3/4th of the total length of the cylinder. Before doing the test the technique of the measurement were demonstrated to the subjects. At least two or three reading was taken and best effort was selected. The subjects were made to sit comfortable in a stool, nose was clipped and the mouthpiece was inserted between the teeth and the lips, now the subject was allowed to breathe the room air this was done to make him familiar to breath through the mouthpiece with nose clipped. After a gap of one minute the free breathing valve was turned to connect the subject to spirometer and immediately the kymograph started at a speed of 60mm/min and normal breathing was recorded for about one minute. This was used for computing the tidal volume. The subject was then instructed to breath in with a maximal effort. He was also instructed before not to breath in, while he is breathing out. At least three such curves were obtained and maximum of the three values were taken for calculation purpose. Now the subjects were instructed to breath in and out as rapidly and as deeply as he or she can for a period of 15 seconds keeping the kymograph at the same speed (60mm/min). The pulmonary ventilation thus calculated from the record called the maximum voluntary ventilation.

Peak expiratory flow rate was measured by using a Mini Wright Peak Flow Meter. After practical demonstration the subjects were asked to inspire as deeply as possible and blow as hard and quickly as possible in one short sharp blast in the peak flow meter. The indicator was stop at a figure on the scale and noted this reading. At least three reading were taken and the highest value out of the three was recorded.

RESULTS

In the present study the male individuals are devided into three groups according to their BSA Group1 have BSA 1.39-1.49Sq/m, Group2 have BSA 1.5-1.89Sq/m, Group3 1.7-1.89Sq/m and female individuals were devided into two groups Group1 have BSA 1.3-1.49 Sq/m, Group2 1.5-1.69 Sq/m.

TABLE1: showing the relationship of PFT with BSA (Sq/m) in males

Lung parameters	Group1		Group2		Group3	
	MEAN	SD	MEAN	SD	MEAN	SD
TV	418.24	21.57	469.50	25.34	500.00	15.20
IRV	1593.53	91.50	1741.33	112.27	1981.60	35.20
ERV	1055.88	42.87	1078.33	37.28	1100.00	13.80
VC	3067.65	105.98	3289.16	122.50	3513.95	22.80
MVV	82.05	9.82	88.53	9.85	104.36	40.50
PEFR	539.41	41.75	575.50	61.79	584.18	3.27

From the table 1 in case of BSA in males, it has been observed that all the component of lung function except PEFR (Pvalue >0.05) tend to increased significantly (Pvalue<0.01) with the increase in BSA in males.

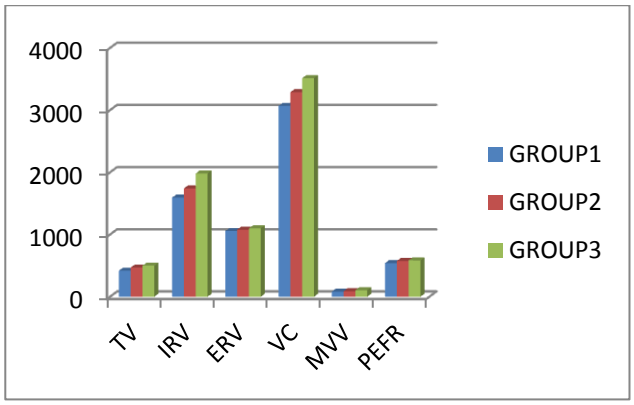
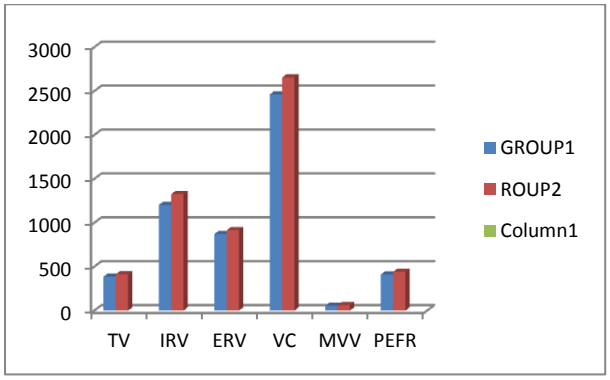


TABLE 2: showing the relationship between PFT and BSA (Sq/m) in males

LUNG PARAMETERS	GROUP1		GROUP2	
	MEAN	SD	MEAN	SD
TV	386.13	34.25	413.88	20.18
IRV	1205.00	47.27	1326.67	53.66
ERV	871.82	29.03	915.28	33.85
VC	2463.18	90.75	2655.83	77.87
MVV	54.37	5.56	62.25	4.64
PEFR	410.91	34.36	441.11	45.66

From table 2 it has been found that there is highly to very highly significant differences in the mean values of different lung function between two BSA groups in females, all the parameters were more in group 2 in comparison to group1



So from the present study it has been found that increase in body surface area is associated with the increase in lung function tests parameters.

DISCUSSION

In the present study it has been found that increase in BSA is associated with increase in lung volumes and PEFR both in male and female.

Discussion: in the present study showed that in male individuals all parameters except the PEFR have positive correlation with the body surface area. In the female individuals all the lung function parameters have positive correlation with the body surface area. Similar findings are also found in the following study.

G . Gromby and B. Sderholm (1963) found the mean values of Vc and MVV 4.89L and 1.59L/min respectively in males and 3.38L and 107L/min in female which is due to the difference in body surface area in male and female individuals.[(2)]

In the present study it was found that as BAS increase PEFR values were also increase in both male and female and at the same BSA group male values are more than the female values. But there was no comparison of male and female PEFR values in 1.7-1.89 BSa group because no female candidate were found for that group.

Whitfield et al found a positive correlation between VC and height, weight and BSA in their study. in our present study we also found a positive correlation off all lung parameters with BSA. That is increase body surface area related with the increase in lung function parameters.[(3)]

Singh et al measure PEFR 851 healthy South Indian men and women and they found that PEFR was best correlate with height in the subjects below 30 yrs and in older subjects. In their study BSA did not shoe consistent relation with PEFR.

S. Natarajan and K. Radha recorded PEFR in2060 healthy South Indian, they found that as the age advances above 35yrs there is gradual decline in values and height is one of the most important factor which determines the PEFR in an individual.

Mike et al in their study measured PEFR in 414 subjects and they observed that PEFR values in Indian were lower than the western population. They also observed that PEFR was linearly related

to height. The higher PEFR values in western subjects appear to be partly due to their bigger physical build.

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