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Study of effect of obesity on Pulmonary Function

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Introduction

Obesity has become so common in developed and developing nations that presently it replaces under-nutrition and infectious diseases as the most significant contributor to ill health. Globally it is assumed that there are more than 1 billion overweight adults and at least 300 million of them are obese. In the developing countries obesity is more prevalent in affluent class. A number of factors contribute towards becoming overweight, such as genetic, lifestyle habits, endocrine problems, genetic syndromes and medications.

Obesity has proved to be a major risk factor for a whole range of cardiorespiratory disorders. Obesity can profoundly alter pulmonary function and diminish exercise capacity by its adverse effects on respiratory mechanics, respiratory muscle function, lung volumes, work and energy cost of breathing and gas exchange. It is the most common precipitating factor for obstructive sleep apnea and obesity hypoventilation syndrome, both of which are associated with substantial morbidity and increased mortality.

Thus obesity has a direct effect on the mechanical behavior of the respiratory system by altering lung volumes, airway caliber or respiratory muscle strength. Hence the effect of obesity on lung functions is well established.

This study intends to find the alteration in the pulmonary functions in overweight individuals as compared with the normal weight individuals (based on World Health Organisation criteria for Body Mass Index)

Aims:

1) To record the pulmonary function test parameters in normal weight and overweight young adults. That is
   - Forced Vital Capacity (FVC)
   - Forced Expiratory Volume in first second (FEV_1)
   - Peak Expiratory Flow Rate (PEFR)
2) To compare these parameters recorded between normal weight and overweight young adults.
3) To observe the pattern of changes in the pulmonary functions with increase BMI

Materials and Methods

Source of Data

Data is collected from 59 young adults selected by simple random sampling

Inclusion Criteria

1) Age 16- 40 years.
2) Individuals falling within the range of normal and overweight, obese according to Body Mass Index.
3) Healthy individuals

Exclusion Criteria

1) Those who have physical deformities of chest wall.
2) Individuals suffering from respiratory diseases such as chronic obstructive pulmonary disease, bronchiectasis and interstitial lung diseases that might affect the pulmonary function.
3) Individuals with present or past (in the last three months) upper respiratory tract or lower respiratory tract infections.
4) Individuals with history of chronic exposure to substances which results in altered pulmonary functions.
5) Smokers and individuals suffering from hypertension.
6) Alcoholics and individuals suffering from Diabetes Mellitus.

The selected group of subjects are categorised into normal weight and overweight based on World Health Organization categorisation of body mass index.

Body Mass Index Scale

BMI	STATUS
<18.5	UNDER WEIGHT
18.5-24.99	NORMAL WEIGHT
25-29.99	OVER WEIGHT
30 and above	OBESITY

The preliminary data of the selected group of subjects, that is height in centimeters and weight in kilograms (rounded off to the nearest whole number) is measured using a measuring tape and a weighing machine respectively. Then the body mass index is calculated using the formula,

B M I= weight (in kgs) / (height)^2 (in mts)

Results

Age in Years(fig1)

	Frequency	Percent
15-20	21	35.6%
20-25	5	8.5%
25-30	11	18.6%
30-35	6	10.2%
35-40	9	15.3%
40-45	4	6.8%
45-50	3	5.1%
Total	59	100.0%

The above table shows distribution of study samples according to age in years. The maximum number (35.6%) of study subjects were in the age group 15-20 years followed by 25-30 years (18.6%).

Gender-wise Distribution(fig2)

	Frequency	Percent
Male	24	40.7%
Female	35	59.3%
Total	59	100.0%

Out of total study subjects, 24 (40.7%) were males and 35 (59.3%) were females.

Descriptive Statistics (fig 3)

	Sex	N	Mean	SD	SEM
Age	Male	24	33.625	8.561	1.747
	Female	35	24.829	8.992	1.520
BMI	Male	24	32.921	5.213	1.064
	Female	35	31.223	4.982	0.842
Waist	Male	24	139.333	183.421	37.441
	Female	35	104.629	13.552	2.291
HIP	Male	24	103.542	5.808	1.186
	Female	35	103.571	6.113	1.033
Height	Male	24	172.458	8.097	1.653
	Female	35	156.343	17.962	3.036
Weight	Male	24	96.333	15.390	3.141
	Female	35	81.543	18.578	3.140
CBC	Male	24	13.983	0.988	0.202
	Female	35	12.337	0.873	0.148

The above table shows descriptive statistics for various study parameters.

(Fig 4)

Correlations								
		BMI	TLC_Pred	FRC_Pred	FVC_Pred	ERV_Pred	RV	DLCO_Pred
BMI	Pearson Correlation	1	-.139	-.103	.025	-.157	.113	.083
	Sig. (2-tailed)		.295	.439	.852	.235	.395	.530
	N	59	59	59	59	59	59	59
TLC_Pred	Pearson Correlation	-.139	1	.552**	.281*	.382**	.020	.675**
	Sig. (2-tailed)	.295		.000	.031	.003	.883	.000
	N	59	59	59	59	59	59	59
FRC_Pred	Pearson Correlation	-.103	.552**	1	.143	.549**	.049	.193
	Sig. (2-tailed)	.439	.000		.280	.000	.714	.143
	N	59	59	59	59	59	59	59
FVC_Pred	Pearson Correlation	.025	.281*	.143	1	.192	-.153	.158
	Sig. (2-tailed)	.852	.031	.280		.145	.246	.233
	N	59	59	59	59	59	59	59
ERV_Pred	Pearson Correlation	-.157	.382**	.549**	.192	1	-.179	.263*
	Sig. (2-tailed)	.235	.003	.000	.145		.176	.045
	N	59	59	59	59	59	59	59
RV	Pearson Correlation	.113	.020	.049	-.153	-.179	1	.284*
	Sig. (2-tailed)	.395	.883	.714	.246	.176		.029
	N	59	59	59	59	59	59	59
DLCO_Pred	Pearson Correlation	.083	.675**	.193	.158	.263*	.284*	1
	Sig. (2-tailed)	.530	.000	.143	.233	.045	.029	
	N	59	59	59	59	59	59	59
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

The above table shows Karl Pearson's correlation coefficient between various study parameters.

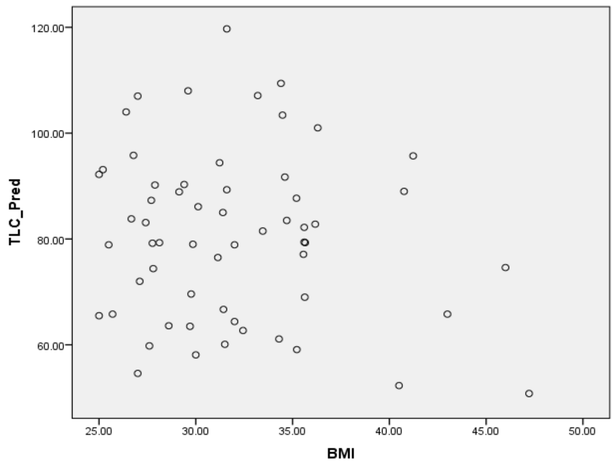

Figure 5: Above chart shows correlation between TLC Predicted and BMI. The Pearson's correlation coefficient was found to be -0.139 (p >.05) which indicates a non-significant negative correlation between BMI and TLC Predicted.

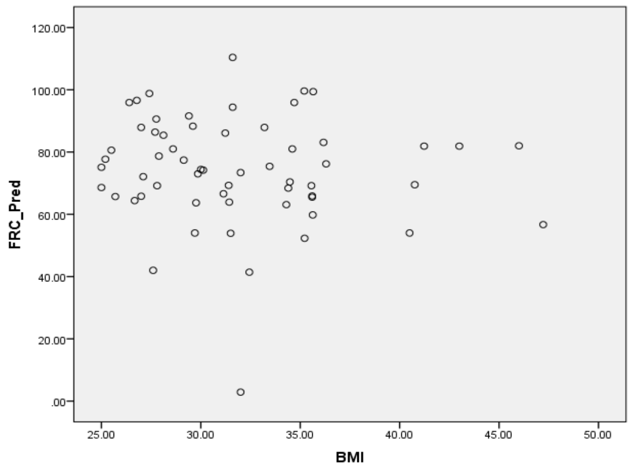

Figure 6: Above chart shows correlation between FRC Predicted and BMI. The Pearson's correlation coefficient was found to be -0.103 (p >.05) which indicates a non-significant negative correlation between BMI and FRC Predicted.

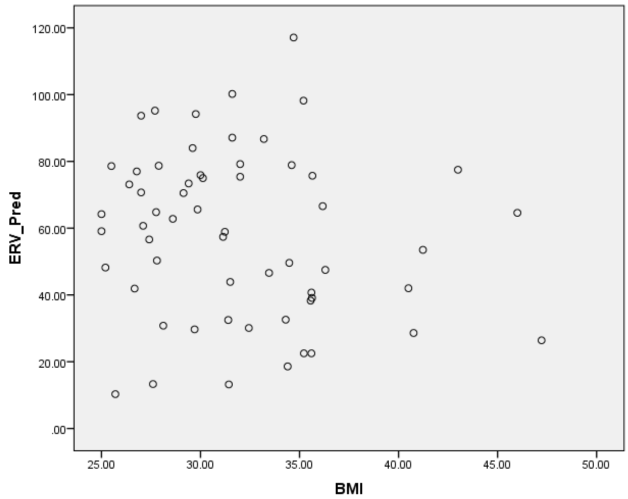

Figure 7: Above chart shows correlation between ERV Predicted and BMI. The Pearson's correlation coefficient was found to be 0.025 (p >.05) which indicates a non-significant positive correlation between BMI and ERV Predicted.

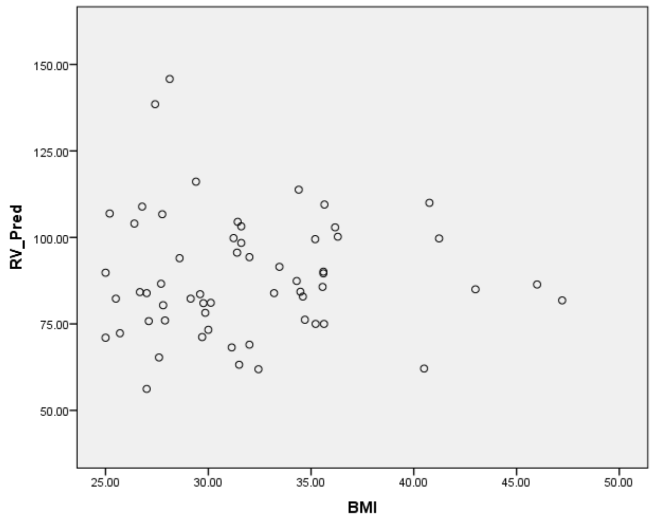

Figure 8: Above chart shows correlation between RV Predicted and BMI. The Pearson's correlation coefficient was found to be 0.113 (p >.05) which indicates a non-significant positive correlation between BMI and RV Predicted.

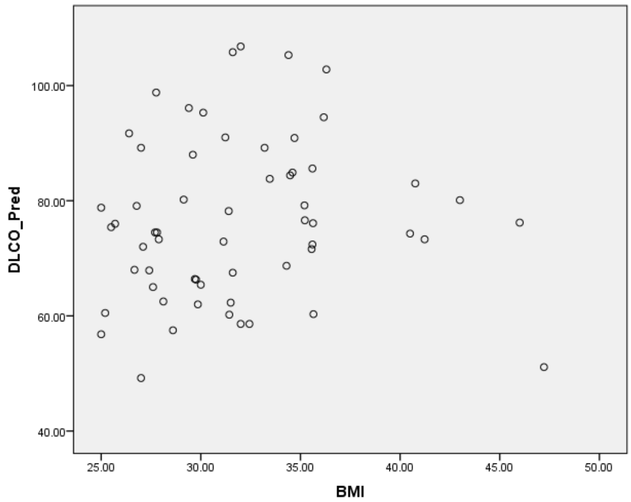

Figure 9: Above chart shows correlation between DLCO Predicted and BMI. The Pearson's correlation coefficient was found to be 0.083 (p >.05) which indicates a non-significant positive correlation between BMI and DLCO Predicted.

Discussion

In our study we fond negative but non significant correlation between BMI & TLC, BMI & FRC

There was positive but non significant correlation between BMI &ERV, BMI & RV

Also we found there was positive but non significant correlation between BMI &DLCO

Figure 1. Shows distribution of study samples according to age in years. The maximum number (35.6%) of study subjects were in the age group 15-20 years followed by 25-30 years (18.6%).

Figure 2. Shows out of total study subjects, 24 (40.7%) were males and 35 (59.3%) were females.

Figure 5.Shows correlation between TLC Predicted and BMI. The Pearson's correlation coefficient was found to be -0.139 (p >.05) which indicates a non-significant negative correlation between BMI and TLC Predicted

Figure 6. Shows correlation between FRC Predicted and BMI. The Pearson's correlation coefficient was found to be -0.103 (p >.05) which indicates a non-significant negative correlation between BMI and FRC Predicted

Figure 7. Shows correlation between FRC Predicted and BMI. The Pearson's correlation coefficient was found to be 0.025 (p >.05) which

indicates a non-significant positive correlation between BMI and FRV Predicted.

Figure 8. Shows correlation between RV Predicted and BMI. The Pearson's correlation coefficient was found to be 0.113 (p >.05) which indicates a non-significant positive correlation between BMI and RV Predicted.

Figure 9. Shows correlation between DLCO Predicted and BMI. The Pearson's correlation coefficient was found to be 0.083 (p >.05) which indicates a non-significant positive correlation between BMI and DLCO Predicted.

Conclusion

In our study we found negative but non significant correlation between BMI & TLC, BMI & FRC. There was positive but non significant correlation between BMI &ERV, BMI & RV. Also we found there was positive but non significant correlation between BMI &DLCO. Lung functions are more likely to show better coorelation with indices of abdominal obesity like waist circumference & waist /hip ratio than the index of general obesity like BMI

The major limitation of our study is smaller sample size. Also the duration and cause of increased BMI was not known. Another limitation is that, we could not record all the lung function test parameters and lung volumes. Future longitudinal studies incorporating a larger sample size can be taken up to study the effect of BMI & waist circumference, waist /hip ratio on lung volumes and lung function tests to provide a deeper insight.

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