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Research Article

ASSESSMENT OF PULMONARY FUNCTIONS IN YOUNG OBESE MALES AND FEMALES IN THE AGE GROUP 18-25 YEARS

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ABSTRACT
The paper reports the pulmonary functions in obese young male and female subjects and compare the results with controls, 60 obese (30 males, 30 females) and 60 non-obese (30 males, 30 females) healthy young adults aged 18-25 years were selected based on body mass index (BMI). Pulmonary function tests were done using computerized RMS Medspiror. The study reveals that the pulmonary functions are reduced in obese group when compared with controls (non-obese groups).

Key words: *Pulmonary functions, Body Mass Index (BMI), Obese*

INTRODUCTION
Obesity is a world wide public health problem with increasing incidence and prevalence, high costs and poor outcomes. As a disease, with defined Pathologic and pathophysiologic complications, it is just about a century old. Kasper *et al.,* (2000) defined obesity as a state of excess adipose tissue mass. Marcus *et al.,* (1998) suggested that the obese individuals have an increased prevalence of pulmonary disorders. Severe clinical obesity is associated with impairment of lung functions.
Eisenmann *et al.,* (2007) examined the influence of obesity on pulmonary function in Navajo and Hopi children and concluded that significant differences among obese and non-obese groups existed for FEV_1% and $FEF_{25-75\%}$ in boys and FVC and FEV_1 in girls.
A1-Badar *et al.,* (2008) studied the relationship between obesity and pulmonary ventilatory functions in Kuwaiti adults. For the whole group, males or females, BMI and waist hip ratio were poor individual predictors of pulmonary ventilatory functions.
Joshi *et al.,* (2008) assessed the correlation of pulmonary functions with body fat percentage in young individuals and concluded that, in males and females overweight groups expiratory reserve volume (ERV), Forced vital capacity (FVC) and maximum ventilatory volume (MVV) are decreased significantly.
Saxena *et al.,* (2008) studied the dynamic pulmonary function tests in obese and non-obese young adults of Gharwal (uttrakhand, India) of 20-40 years of age group, randomly selected from the employees of Himalayan Institute of Medical Sciences, the results indicated significantly lower value of (FVC) forced vital capacity (2.89 $\pm$ 0.29) and FEV in 1st Sec (2.59 $\pm$ 0.25) in obese females.
A perusal of literature reveals that a systematic work, on the assessment of pulmonary functions in young obese male and females was not done earlier, therefore the present study is taken up.

MATERIALS AND METHODS
The present study was conducted in the Department of Physiology, J.J.M. Medical College, Davangere.
60 obese and 60 non-obese young males and females of the age group 18-25 years were selected randomly from the general population of Davangere city (students, healthy attendants of patients of Bapuji Hospital).

Inclusion Criteria
Young obese males and females aged 18-25 years.
Young non obese males and females aged 18-25 years.

Exclusion Criteria
Age below 18 years and above 25 years, Subjects with history of Asthma, diabetes mellitus, hypertension, other cardiovascular diseases, endocrine disease or surgery, Subjects on chronic

medication, Smokers, Alcoholics, Subjects with noticeable weight gain or weight loss over the preceding 3 months, Subjects having any neuro-muscular disorders.
The benchmark for obesity was taken on the basis of body mass index as per the standard protocol.
Height (m) and weight (kg) of the subjects were recorded and BMI calculated as per Quetelet's index.

$$\text{Body mass index} = \frac{\text{Weight (kilogram)}}{\text{Height}^2\text{ (meter)}}$$

Pulmonary function tests

Pulmonary function tests were performed using RMS medspiror. This Spiro meter has a mouth piece attached to a transducer assembly which is connected to an adapter box and this is connected to the computer by a serial cable. Software from Recorders and Medicare system is loaded onto the computer. This software allows the calculation of the predicted values for age, sex, weight and height and it also gives the recorded values of all the parameters.
Subjects were motivated prior to the start of maneuver. The subjects were made to sit on a stool. The subjects were asked to place the mouth piece firmly in the mouth and to take a maximum inspiration, then nostrils were closed using a nose clip and subject was asked to execute a maximum forced expiration with full efforts and this is followed by a maximum forced inspiration through mouthpiece. The test was performed over 3 maneuvers. The tests with the best maneuver were selected. The machine gives us the comparison of various parameters between 3 maneuvers and we accepted the best maneuver.
The results for each parameter were compared between the obese and non obese groups and statistically analyzed.

RESULTS AND DISCUSSION

60 obese (30 males and 30 females) subjects and 60 non obese (30 males and 30 females) subjects were analyzed for the results. The results obtained were expressed as mean ± standard deviation. The differences in the mean values of each respiratory parameter between obese and non-obese males and females are shown in tables (Table 1 – Table 10).
It is evident from the study that a statistically significant decrease in Forced vital capacity (FVC), Forced expiratory volume in the 1st second, (FEV_1) forced expiratory volume in first 3 seconds (FEV_3), mean forced expiratory flow during 25-75% of expiration and peak expiratory flow rate (PEFR) in obese males and females subjects when compared to non-obese males and females controls.

Table 1: Comparison of Fvc between Non Obese and Obese Males

Groups	n	Actual value (L)		% predicted	
		Range	**Mean ± SD**	**Range**	**Mean ± SD**
Non-obese	30	2.56 – 3.62	3.20 ± 0.26	68-106	90.3 ± 8.8
Obese	30	1.50 – 3.91	2.08 ± 0.58	60-111	73.8 ± 10.1
Mean Difference		1.12		16.5	
Significance	t-value	9.65		6.75	
	p-value	<0.001,HS		<0.001,HS	

** unpaired 't' test HS – Highly significant*

Table 2: Comparison of Fvc between Non Obese and Obese Females

Groups	n	Actual value (L)		% predicted	
		Range	**Mean ± SD**	**Range**	**Mean ± SD**
Non-obese	30	1.85 – 3.43	2.37 ± 0.37	72-106	87.8 ± 8.9
Obese	30	1.53 – 3.06	2.05 ± 0.39	48-88	69.8 ± 8.6
Mean Difference		0.32		18.0	
Significance	t-value	3.26		7.97	
	p-value	<0.01,S		<0.001,HS	

** unpaired 't' test HS – Highly significant*

Table 3: Comparison of Fev$_1$ between Non Obese and Obese Males

Groups	n	Actual value (L)		% predicted	
		Range	**Mean ± SD**	**Range**	**Mean ± SD**
Non-obese	30	2.46 – 3.62	3.07 ± 0.27	74-115	98.2 ± 10.2
Obese	30	1.10 – 3.72	1.74 ± 0.67	60-122	71.6 ± 14.6
Mean Difference		1.33		26.6	
Significance	t-value	10.08		8.18	
	p-value	<0.001,HS		<0.001,HS	

** unpaired 't' test HS – Highly significant*

Table 4: Comparison of Fev$_1$ between Non Obese and Obese Females

Groups	n	Actual value (L)		% predicted	
		Range	**Mean ± SD**	**Range**	**Mean ± SD**
Non-obese	30	1.85 – 2.84	2.28 ± 0.29	82-120	103.5 ± 9.8
Obese	30	1.10 – 2.49	1.72 ± 0.39	58-84	70.4 ± 7.5
Mean Difference		0.56		33.1	
Significance	t-value	6.64		14.69	
	p-value	<0.001, HS		<0.001,HS	

** unpaired 't' test HS – Highly significant*

Table 5: Comparison of Fev$_3$ between Non Obese and Obese Males

Groups	n	Actual value (L)		% predicted	
		Range	**Mean ± SD**	**Range**	**Mean ± SD**
Non-obese	30	1.89 – 3.82	2.93 ± 0.47	67-107	86.4 ± 13.0
Obese	30	1.25 – 3.92	1.88 ± 0.66	60-115	73.3 ± 13.1
Mean Difference		1.05		13.1	
Significance	t-value	> 0.10		3.89	
	p-value	<0.001,HS		<0.001,HS	

** unpaired 't' test HS – Highly significant*

Table 6: Comparison of Fev$_3$ between Non Obese and Obese Females

Groups	n	Actual value (L)		% predicted	
		Range	**Mean + SD**	**Range**	**Mean + SD**
Non-obese	30	1.89 – 3.45	2.37 + 0.37	74 - 110	90.6 + 9.1
Obese	30	1.21 – 3.06	1.91 + 0.36	48 - 88	68.9 + 8.8
Mean Difference		0.46		21.7	
Significance	t-value	4.88		9.39	
	p-value	<0.001, HS		<0.001,HS	

** unpaired 't' test HS – Highly significant*

Table 7: Comparison of Pefr between Non Obese and Obese Males

Groups	n	Actual value (L)		% predicted	
		Range	**Mean + SD**	**Range**	**Mean + SD**
Non-obese	30	4.76 – 10.18	8.43 + 1.10	47-110	92.1 + 12.6
Obese	30	4.74 – 9.38	5.99 + 1.03	64-102	76.4 + 7.6
Mean Difference		2.44		15.7	
Significance	t-value	8.87		5.84	
	p-value	<0.001,HS		<0.001,HS	

** unpaired 't' test HS – Highly significant*

Table 8: Comparison of Pefr between Non Obese and Obese Females

Groups	n	Actual value (L)		% predicted	
		Range	Mean + SD	Range	Mean + SD
Non-obese	30	4.10 – 9.11	6.29 ± 1.40	74 - 110	86.0 ± 13.5
Obese	30	3.94 – 7.20	5.17 ± 0.86	48 - 88	65.3 ± 9.8
Mean Difference		1.12		20.7	
Significance	t-value	3.73		6.80	
	p-value	<0.001, HS		<0.001,HS	

** unpaired't' test HS – Highly significant*

Table 9: Comparison of Fef$_{25-75\%}$ between Non Obese and Obese Males

Groups	n	Actual value (L)		% predicted	
		Range	Mean + SD	Range	Mean + SD
Non-obese	30	2.98 – 7.69	4.73 + 0.90	62-152	102.4 + 18.8
Obese	30	2.04 – 6.01	2.78 + 0.85	59-122	69.3 + 13.8
Mean Difference		1.55		33.1	
Significance	t-value	6.86		7.77	
	p-value	<0.001,HS		<0.001,HS	

** unpaired't' test HS – Highly significant*

Table 10: Comparison of Fef$_{25-75\%}$ between Non Obese and Obese Females

Groups	n	Actual value (L)		% predicted	
		Range	Mean + SD	Range	Mean + SD
Non-obese	30	2.16 – 5.02	3.51 + 0.88	55 - 150	95.6 + 22.6
Obese	30	1.57 – 4.33	2.57 + 0.64	57 - 90	68.3 + 8.3
Mean Difference		0.94		0.29	
Significance	t-value	4.73		6.21	
	p-value	<0.001, HS		<0.001,HS	

** unpaired't' test HS – Highly significant*

Obesity might impair pulmonary function via several mechanisms. Obese individuals have an increased demand for ventilation and breathing work load, respiratory muscle inefficiency, decreased functional reserve capacity and expiratory reserve volume and closure of peripheral lung units. Obesity also influences upper airway reflexes, lung mechanics and may affect the central control of breathing. It adversely affects chest wall mechanics, and causes a decrease in total respiratory compliance due to deposition of subcutaneous adipose tissue. There is also a decrease in lung compliance due to increased pulmonary blood volume. Respiratory muscle function might also be impaired in obesity due to the mechanical disadvantage induced by changes in chest wall configuration, fat deposition and increased energy expenditure to expand the lungs, and an increase in intra-abdominal adipose tissue which interferes with the mechanical properties of the chest wall causing decrease in compliance and preventing full excursion of the diaphragm. There are also effects of obesity on upper airway tone and hence resistance, which and a mechanical load that increases the work of breathing. Morbid obesity may also induce restrictive disturbance of respiratory function, related to reduce compliance of chest wall and or pulmonary parenchyma.

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