Original Research Article

A Cross Sectional Study of Relationship Between $FEF_{25-75\ \%}$ and Body Mass Index Among Young Obese

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Abstract

Background: The aim of the study was to to find out the relationship between $FEF_{25-75\ \%}$ and BMI and compare the variations among underweight and overweight. **Methods**: After applying inclusion and exclusion criteria 210 subjects were included (aged between 18 years-25 years) in this study. **Results**: Mean predicted value of FEF 25-75 L/S is significantly decreased (p value<0.05) in group A (Underweight), group E (obese class 2) and group F (obese class 3) when compared to control subjects group B.**Conclusion**: There was statistically significant decrease in $FEF_{25-75\%}$ in group A (underweight), group E (obese class 2) and group F (obese class 3) as compared to control group B.

Keywords: Obesity, Body Mass Index, $FEF_{25-75\ \%}$,Spirometry.

Introduction

In recent years obesity has emerged as a chronic and multifactorial disorder.In the year 2000, WHO defined obesity as a "medical condition which involves excessive accumulation of fat leading to adverse health outcomes"[1].Maincause of obesity is imbalance between caloric consumption and its usage. Lack of an active life style, bad food habits, socio-economic conditions along with genetic predisposition and diseases like hypothyroidism, Cushing's syndrome, polycystic ovarian disease, contribute to the global burden of this order.BMI is the best assessment of obesity besides skin fold thickness, waist circumference, waist to hip ratio and ideal body weight for height.Obesity has led to severe deleterious effects on various systems in our body. Respiratory system is not an exception.Marked negative impact has been observed on the pulmonary functions due to obesity due to deterioration of respiratory muscle function. Breathlessness is the most common complaint among overweight and obese adults.Pulmonary function tests have emerged as a very important tool which are not only good in assessing and predicting the level of pulmonary dysfunction but also can be easily carried out withleast discomfort to the subjects.

Several studies , done so far, have increasingly related obesity with respiratory dysfunction and diminished pulmonary function parameters such as FEV1,FVC,PEFR. The results obtained point towards hampered respiratory mechanics. Among the forced expiratory volumes $FEF_{25-75\ \%}$ is defined as the mean forced expiratory flow during the middle half of FVC. It measures the average flow rate on FVC segment which indicates the flow rate in medium and small caliber airways[2].$FEF_{25-75\ \%}$ is considered abnormal if its value is less than 65% of the predicted value[3-5].Abnormal value indicates early obstruction to the airflow.

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Few studies, done so far indicate some relation between $FEF_{25-75\%}$ and BMI.Some studies have shown significant relationship of $FEF_{25-75\ \%}$with asthma[6-8].In present study we tried to find out the relationship between $FEF_{25-75\ \%}$ and BMI. We also tried to study and compare the variations among underweight and overweight.

Aim

The aim of this study was to study the relationship between $FEF_{25-75\ \%}$ and body mass index among young obese.

Material and methods

The study was done in the Department of Physiology, PMCH, and Patna after taking approval from the ethical committee.

Study design – Cross Sectional study to compare $FEF_{25-75\%\ in}$ relation to BMI in age group of 18 – 25 years.

Study groups- Randomselection of subjects from medical and paramedical staff (age groups of 18-25 years) of Patna Medical College & Hospital, Patna.

The groups were formed according to the International Classification of BMI [11] and were calculated by using Quetlet's index (body weight in kg/height in m^2).

Groups	**BMI (kg/m^2)**
Group A	Underweight <18.50
Group B	Normal range (control) 18.50-24.99
	Overweight ≥25. 00
Group C	Pre-obese 25.00-29.99
Group D	obese class 1 30.00-34.99
Group E	obese class 2 35.00-39.99
Group F	obese class 3 ≥40. 00

Inclusion Criteria

1. Subjects aged between 18 -25 years who gave written consent
2. Had no history of smoking and were free from any systemic disease.
3. Had no physical deformities of the chest wall.

Exclusion Criteria

1.Individuals with last 3 months history of respiratory tract infection and those suffering from respiratory diseases (tuberculosis, COPD & interstitial lung disease) and systemic diseases (diabetes mellitus and hypertension.)

2. Subject with deformities of the chest wall.

Detailed history was taken and Spirometry was done with the help of Helios 401.

Statistical Analysis: Mean ± Standard deviation was used to express the data which was obtained in different study groups.Mean between the two groups were compared with help of SPSS17.0 (statistical software).If p-value was <0.05 it was considered statistically significant.Data were analyzed using unpaired T-test (α error set at 5%).

Result

In this cross-sectional study 210 subjects from medical and paramedical students were randomly selected. The groups (N=210, case= 132 and control= 78) are divided into group A, B, C, D, E and F respectively each having 21, 78, 40. 35, 29 and 7 subjects on the basis of BMI.The spirometric parameter $FEF_{25-75\ \%}$ wasstudied with respect to BMI.

Table 1:Comparison of M. PRED Mean value of FEF 25-75 L/S and SD between Group A and Group B

Group According to BMI	N	Range (L/S)	Mean	SD	t-value	P. Level	Significant
A	21	1.01 – 5.25	3.53	1.12	2.42	< 0.05	S
B(control)	78	1.41 – 8.15	4.42	1.58			

* S- significant. , M. PRED-Measured Predicted

Table 1 shows that the M. PRED Mean value of FEF 25-75 L/S of Group A and Group B is 3.53 and 4.42 respectively, but the p-value is less than 0.05 levels. So there is a significant change in FEF 25-75 L/S between groups A and B.

Table 2:Comparison of M. PRED Mean value of FEF 25-75 L/S and SD between Group B and Group C

Group According to BMI	N	Range (L/S)	Mean	SD	t-value	P. Level	Significant
B(control)	78	1.41-8.15	4.42	1.58	1.31	>0.05	NS
C	40	1.46-7.02	4.04	1.30			

*NS-not significant, M. PRED-Measured Predicted

Table 2 shows that the M. PRED Mean value of FEF 25-75 L/S of Group B and Group C is 4.42 and 4.04 respectively, but the p-value is more than 0.05 levels. So there is no any significant change in FEF 25-75 L/S between groups B and C.

Table 3:Comparison of M. PRED Mean value of FEF 25-75 L/S and SD between Group B and Group D

Group According to BMI	N	Range (L/S)	Mean	SD	t-value	P. Level	Significant
B(control)	78	1.41-8.15	4.42	1.58	1.69	>0.05	NS
D	35	1.63-7.62	3.89	1.45			

*NS-not significant, M. PRED-Measured Predicted

Table 3 shows that the M. PRED Mean value of FEF 25-75 L/S of Group B and Group D is 4.42 and 3.89 respectively but the p-value is more than 0.05 levels. So there no significant change in FEF 25-75 L/S between groups B and D.

Table 4:Comparison of M. PRED Mean value of FEF 25-75 L/S and SD between Group B and Group E

Group According to BMI	N	Range (L/S)	Mean	SD	t-value	P. Level	Significant
B(control)	78	1.41-8.15	4.42	1.58	4.91	<0.001	HS
E	29	1.71-4.96	2.91	0.79			

*HS-highly significant, M. PRED-Measured Predicted

Table 4 shows that the M. PRED Mean value of FEF 25-75 L/S of Group B and Group E is 4.42 and 2.91 respectively but the p-value is less than 0.001 levels. So there is highly significant change in FEF 25-75 L/S between groups B and E.

Table 5:Comparison of M. PRED Mean value of FEF 25-75 L/S and SD between Group B and Group F

Group According to BMI	N	Range (L/S)	Mean	SD	t-value	P. Level	Significant
B(control)	78	1.41-8.15	4.42	1.58	2.96	<0.01	S
F	7	0.88-4.18	2.61	1.05			

* S- significant, M. PRED-Measured Predicted

Table shows that the M. PRED Mean value of FEF 25-75 L/S of Group B and Group F is 4.42 and 2.61 respectively, but the p-value is less than 0.01 levels. So there is a significant change in FEF 25-75 L/S between groups B and F.

Discussion

FEF 25-75 (L/S) describes the amount of air expelled from the lung during the middle half of the forced vital capacity test. Recent research suggests that FEF 25-75% or FEF 25-50% may be a more sensitive parameter than FEV1 in the detection of obstructive small airway disease[10,11]. In our study mean predicted value of FEF 25-75 L/S is significantly decreased (p value<0.05) in group A (underweight) 3.53±1.12, group E(obese class 2) 2.91±.79 and group F (obese class 3) 2.61±1.05 when compared to control subjects group B 4.42±1.58. Our result agreed with those of Emel Torun et studies[12].They also found an inverse correlation between BMI and $FEF_{25-75\%}$. This could be explained by air flow limitation related to lower inspiratory pressure and flow as well as reduced respiratory muscle strength. Also a study done by Rebec C et al, stressed upon the fact that obesity resulted in reduced compliance as well as reduction in normal diaphragmatic movement because of excessive abdominal fat[13]. All this resulted in reduced lung parameters.There was statistically significant decrease in $FEF_{25-75\%}$ in group A (underweight) as compared to control group B.Reduction in the pulmonary functions might be associated with malnutrition and lack of energy in the underweight population[14].Due to malnutrition the defense mechanism of the lung immune system and strength and endurance of respiratory muscle mass decreases and affects the lung functions. Muscle wasting leads to the reduction in the diaphragmatic mass and a weaker respiratory muscle function diminishes the respiratory muscle strength and it changes the ventilator capacity.

Conclusion

Obesity has achieved the status of a major health calamity in present times. Our study pointed towards a significant reduction in $FEF_{25-75\%}$ in obese class 2 and obese class 3.Thus BMI showed a negative correlation with $FEF_{25-75\%}$ especially in moderate and severe obesity. Our study also showed a marked reduction in $FEF_{25-75\%}$ **i**n the underweight group. This could be due to malnutrition.

References

1. Centers for Disease Control and Prevention. 2010. Defining Childhood Overweight and Obesity. Retrieved April 6, 2010 from http://www.cdc.gov/obesity/childhood/defining.html.
2. Ruppel G. Manual of Pulmonary Function Testing,ed 5. St. Louis, Mosby,1991,46-48p.
3. Simon MR, Chinchilli VM, Phillips BR, Sorkness CA, Lemanske RF Jr, Szefler SJ, Taussig L, Bacharier LB, Morgan W. Childhood Asthma Research and Education Network of the National Heart, Lung, and Blood Institute: Forced expiratory flow between 25% and 75% of vital capacity and FEV_1/forced vital capacity ratio in relation to clinical and physiological parameters in asthmatic children with normal FEV_1 values. J Allergy ClinImmunol. 2010;126:527-534.e1-e8.
4. Lipworth B. Targeting the small airways asthma phenotype: if we can reach it, should we treat it? Ann Allergy Asthma Immunol. 2013;110:233-239.
5. Ciprandi G,Capasso M,Tosca M,Salpietro C,Salpietro A, Marseglia G, La Rosa M. A forced expiratory flow at 25-75% value <65% of predicted should be considered abnormal: a real-world, cross-sectional study. Allergy Asthma Proc. 2012;33:e5-e8.
6. Weiss ST, Tosteson TD, Segal MR, Tager IB, Redline S, Speizer FE. Effects of asthma on pulmonary function in children.A longitudinal population-based study. Am Rev Respir Dis. 1992;145:58-64.
7. Lebecque P, Kiakulanda P, Coates AL. Spirometry in the asthmatic child: is FEF25-75 a more sensitive test than FEV1/FVC? Pediatr Pulmonol. 1993;16:19-22.
8. Valetta EA, Piacentini GL, Del Col G, Boner AL. FEF25-75 as a marker of airway obstruction in asthmatic children during reduced mite exposure at high altitude. J Asthma. 1997;34:127-31.
9. Koenig SM. Pulmonary Complications of obesity. Am J Med Sci. 2001; 321:249-79.
10. Ciprandi, Giorgio; Cirillo, Ignazio. "Forced expiratory flow between 25% and 75% of vital capacitymaybe a marker of bronchial impairment in allergic rhinitis". Journal of Allergy and Clinical Immunology. 2011; 127(2):549–549.
11. Emel Torun, ErkanCakir, FatmaOzguç,İlkerTolgaOzgen. The Effect of Obesity Degree on Childhood Pulmonary Function Tests. Balkan Med J. 2014; 31(3):235–238.
12. Rabec C,de Lucas Ramos P,Veale D.Respiratory complications ofobesity. Arch Bronconeumol. 2011; 47:252–261.
13. Sindhu CS.Obesity Assessment Based on BMI in theYoung Adults of Haryana- a state of India. Research Journal of Recent Sciences. 2013; 2:304-7.
14. Costa D, Barbalho CM, Miguel Soares PG, Forti MP,Coutinho Azevedo LM.The impact of obesity on pulmonary function in adult women. Clinics. 2008;63:719-24.

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