Indian Journal of Clinical Anatomy and Physiology 2019;6(3):287–290

Content available at: iponlinejournal.com

Indian Journal of Clinical Anatomy and Physiology

Journal homepage: www.innovativepublication.com

Original Research Article

Correlation between PEFR and regional body fat in the middle aged male subjects – A cross sectional study

C Bharathi[1], T Kannan Kumar[2], R Niruba[1,*]

[1]*Dept. of Physiology, Annapoorana Medical College, Salem, Tamil Nadu, India*
[2]*Ramana Surgical Hospital, Salem, Tamil Nadu, India*

ARTICLE INFO

Article history:
Received 16-04-2019
Accepted 11-09-2019
Available online 12-10-2019

Keywords:
Body Mass Index
Peak Expiratory Flow Rate
Subcutaneous fat
Visceral fat

ABSTRACT

Introduction: Obesity and its related pulmonary morbidities have become global epidemic. Association between altered pulmonary functions and its relation with distribution of fat percentage in the body is analysed in our study.
Material and Methods: Inclusion Criteria : Male subjects in the age group of 35-45 years with BMI between 18.5-30 kg/m^2.
Exclusion Criteria: Diabetics, hypertensives, a lcoholics, smokers and subjects with any other recent illness. BC 601 TANITA Bioimpedence analyser was used to measure visceral fat and subcutaneous fat. PEFR (Peak expiratory flow rate) was measured using Wrights peak expiratory flow meter. BMI was calculated from height and weight of the subjects.
Results: Pearson correlation was applied. PEFR showed significant negative correlation with visceral fat and subcutaneous fat with r value of -0.576 and - 0.409 respectively. PEFR showed only mild negative correlation with BMI with r value - 0.203 when compared to regional fat.
Conclusion: Visceral fat and subcutaneous fat remains a better predictor than BMI in assessing the obesity related morbidity of lung functions.

1. Introduction

Obesity and its related morbidities has reached epidemic proportions with reports from World Health Organization showing 1.9 billion adults being overweight, among which 600 million people are obese.[1] Obesity induced insulin resistance produces low-grade inflammatory condition and proinflammatory cytokines Which leads to systemic inflammation that can impair lung functions.[2–8] In the disease process visceral fat is found to be important for assessing morbidity and mortality due to overweight and obesity. Current clinical guidelines recommend regional fat distribution as major risk factor than body mass index (BMI).[9] Studies show increase in percentage of body fat and central pattern of fat distribution may affect the pulmonary function tests by altering lung compliance, work of breathing and the elastic recoil.[10] Upper body obesity severely compromise lung volumes than lower body obesity.[11–13] To assess quantitative and qualitative estimation of pulmonary functions PEFR remains as a convenient tool which can be easily measured by peak flow meter.[6]

1.1. Rationale of the study

We studied regional fat influence over pulmonary functions as there is paucity of data imposing the importance of areas of fat distribution on pulmonary functions.

1.2. Aim

To study the correlation and identify the better predictor between BMI and regional body fat percentage on pulmonary functions.

* *Corresponding author*.
E-mail address: kktrniruba@gmail.com (R. Niruba).

https://doi.org/10.18231/j.ijcap.2019.063
2394-2118/© 2019 Published by Innovative Publication.

2. Materials and Methods

2.1. Study design

All participants gave a written informed consent to participate in this study. Information details about socio demographic characteristics, family history (Diabetes, Hypertension), respiratory illness, alcohol consumption, cigarette smoking, drug intake, diet history, exercise history, occupational history and history of recent illness were obtained by a structured questionnaire. Institutional ethical committee clearance was obtained.

2.2. Inclusion criteria

100 male subjects in the age group - 35-45 yrs with BMI between 18.5 to < or equal to 30 were included.

2.3. Exclusion criteria

Diabetics, hypertensives, alcoholics, smokers, subjects with any respiratory and other illness in past few days were excluded.

BC 601 TANITA segmental body composition analyser is used for Bioelectric Impedance Analysis (BIA) to measure visceral fat and subcutaneous fat.[14]

2.4. Preparations to do bio impedance analysis

After detailed diet and exercise history data was measured. Measurement is taken 3 times and average is taken. BIA measures the impedance or resistance to the signal as it travels through the water that is found in muscle and fat. BIA introduce into the body a known amount of current (I), of about 800 μ A, most often at a frequency of 50 kHz. The current passes between two electrodes, often called the source and sink (or detector), and generates voltages between different points in the body volume according to Ohm's law. As living tissue constitutes a volume conductor the current flows through all conducting material present in the body in the path between the source and sink electrodes. Results thus obtained are analysed. BMI was calculated from height and weight of the subjects. PEFR was expressed in litres per minute (L/min).[15–19] The PEFR was recorded with Wright's portable peak flow meter in a standing position with pinched nostrils. At intervals subjects were asked to perform deep inspiration and expiration as strong as possible into the instrument. At least three readings were obtained under supervision and the high est of the three was recorded.[20,21]

3. Results

Statistical Analysis was done using SPSS software 16.0 and Pearson correlation was applied. Descriptive statistics of age, visceral fat, subcutaneous fat, PEFR values and BMI of 100 middle aged male subjects mentioned in Table 1 and Table 2 (enclosed) shows Pearson cor relation of PEFR with BMI, subcutaneous fat and visceral fat.

4. Discussion

Studies have established link between obesity and respiratory complications like impaired pulmonary function and airway hyper responsiveness[20,21] both in children and adults which leads to reduced lung volumes and pulmonary morbidities.[22,23] Among the regional fat distribution, truncal obesity and increased subcutaneous fat over the chest may alter pulmonary function by reducing compliance of chest wall, respiratory muscle function and size of peripheral airway and limits diaphragm descent during breathing.[24,25]

Hence in our study we intended to correlate PEFR with BMI and regional body fat distribution and results obtained showed significant negative correlation of PEFR with visceral fat and subcutaneous fat compared to BMI.

As the BMI considers only height and weight, its value on the distribution between adipose tissue and lea n mass are not always accurate.[26] Study by Banerjee J et al also demonstrate compared to BMI, body fat% as a better index for determination of lung function impairments in obese subjects.[27] Collins et al indicated upper body obesity has a more severe impact on the lung volumes as compared to obese patients with lower body obesity.[28]

Study by Cotes et al, says that pulmonary functions are not under the influence of body weight but muscularity and fat distribution plays a significant role.[29] Negative correlation was observed by Bilgin et al between fat% and FVC, MVV, FEV1, and PEFR.[30]

Study by Lazarus et al, observed no effect of central pattern of fat distribution on pu lmonary flow rates but subcutaneous fat was significantly associated with the flow rate[31] which contradicts our study.

Our findings were similar to Saxena et al[32] who reported PEFR is affected by both overall and abdominal adiposity markers among which WHR(waist hip ratio) showed significant negative association with PEFR.

4.1. Implication

This study implies that life style modification and weight reduction can improve pulmonary functions and reduce the mortality and morbidity in obese individuals.

4.2. Limitation

The major limitation of our study is smaller sample size. And we could not record all the lung function test parameters and lung volumes. Future longitudinal studies incorporating a larger sample size in different grades of obesity on lung functions can be done.

Table 1: Description of Age, BMI, visceral fat, subcutaneous fat and PEFR

Age Mean ±SD (in years)	PEFR (L/min)	Visceral fat Mean ± SD (%)	Subcutaneous fat Mean ±SD (%)	BMI kg/m^2
39 ± 4	272.16 ± 6	8.18 ± 2	27.18 ± 4	28.42 ± 4.5

Table 2: Correlation between visceral fat, subcutaneous fat and BMI with PEFR

	PEFR L/min
Visceral fat %	r value - 0.576
Subcutaneous fat%	r value - 0 .409
BMI kg/m^2	r value - 0 .203

5. Conclusion

Our study concludes visceral fat and subcutaneous fat are the better predictors than BMI in assessing pulmonary related morbidities.

6. Source of funding

None.

7. Conflicts of interest

None

References

1. Obesity and overweight. WHO Media centre. Available from: ; 2015,. cited. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/..
2. Ye J, Mcguinness OP. Inflammation during obesity is not all bad: Evidence from animal and human studies. *Am J Physiol Endocrinol Metab*. 2012;10:1152–1152.
3. Smita. Effect of body fat percentage on peak expiratory flow rate in young adults of Indian population. *Indian J Appl Basic Med Sci*. 2014;16(22):51–58.
4. Thyagarajan B, Jacobs DR, Apostol GG, Smith LJ, Lewis CE. Plasma fibrinogen and lung function: the CARDIA Study. *Int J Epidemiol*. 2006;35(4):1001–1008.
5. Thyagarajan, Smith LJ, Barr RG. Association of Circulating Adhesion Molecules with Lung Function: The CARDIA Study. *Chest*. 2009;40(5):100–115.
6. Wright BM, Mckerrow CB. Maximum forced expiratory flow as a measure of ventilatory capacity. *Br Med J*. 1959;2(1):1041–1047.
7. West AJ, Burton D. Effect of obesity on pulmonary function and its association with respiratory disease. *Can J Respir Therapy, Spring*. 2009;60(8):1041–1047.
8. Zerah H, Harf A, Perlemuter L, Lorino H, Lorino AM. Effects of obesity on respiratory resistance. *Chest*. 1993;103(9):1470–1476.
9. Chang H, Beason TS, Hunleth JM, Colditz GA. A systematic review of body fat distribution and mortality in older people. *Maturitas*. 2012;72(3):175–191.
10. Joshi AR, Singh R. Correlation of pulmonary function tests with body fat percentage in young individuals. *Indian J Physiol Pharmacol*. 2008;52(4):383–388.
11. Kissebah AH, Freedman DS, Peiris AN. Health risks of obesity. *Med Clin N America*. 1989;73:111–138.
12. The degree of masculine differentiation of obesities: A factor determining predisposition to diabetes, atherosclerosis, gout, and uric calculous disease. *Am J Clin Nutr*. 1956;4:20–34.
13. Kissebah A, Vydelingum N, Murray R. Relation of body fat distribution to metabolic complications of obesity. *J Clin Endocrinol Metab*. 1982;54:254–260.
14. Jebb SA, Cole TJ, Doman D, Murgatroyd PR, Prentice AM. Evaluation of the novel Tanita body-fat analyser to measure body composition by comparison with a four-compartment model. *Br J Nutr*. 2000;83:115–122.
15. Tyagi R, Kapoor S. Functional ability and nutritional status of Indian elderly. *Open Anthropol J*. 2010;3:200–205.
16. Shenoy PJ, Shivakumar J, Kalpana B, Bhat SK. Impact of adiposity markers on peak expiratory flow rate in young adult south Indian females. *Muller J Med Sci a Res*. 2014;5:121–124.
17. Kaur P, Arora D, Dhillon JK. PEFR and its determinants in a healthy population aged 65 years. *Indian J Applied Pure Bio*. 2012;27(2):141–145.
18. Sandhu PK, Bajaj D, Mehta K. Correlation of peak expiratory flow rate with age and anthropometric parameters in elderly (> 65 years). *Natl J Physiol Pharm Pharmacol*. 2016;6:89–92.
19. Kaur P, Dimple, Bansal R. A study of peak expiratory flow rate in normal elderly punjabies. *J Adv Res I Biol Sci*. 2012;4(3):253–258.
20. Gibson GJ. Obesity, respiratory function and breathlessness. *Thorax*. 2000;55:41–44. Suppl. 1.
21. Rubinstein I, Zamel N, Dubarry L, Hoffstein V. Airflow limitation in morbidly obese, nonsmoking men. *Ann Intern Med*. 1990;112:828–832.
22. Schunemann HJ, Dorn J, Grant BJ. Pulmonary function is a long-term predictor of mortality in the general population: 29- year follow-up of the Buffalo Health Study. *Chest*. 2000;118:656–664.
23. Strachan DP. Ventilatory function, height, and mortality among abdominal obesity and respiratory function. *Am J Epidemiol*. 2004;159:1140–1149.
24. Chen, Rennie Y, Cormier D, Dosman Y, J. Waist circumference is associated with pulmonary functions in normal weight, overweight and obese subjects. *Am J Clin Nutr*. 2007;85:35–39.
25. Ceylan E, Comlekci A, Akkoclu C, Itil O, Ergor G. The effect of body fat distribution on pulmonary tests in overweight and obese. *South Med J*. 2009;102(1):30–35.
26. Aim for a Healthy Weight: Assess your Risk". National Institutes of Health ; 2007,.
27. Banerjee J, Roy A, Singhamahapatra A, Dey PK, Ghosal A. Association of Body Mass Index (BMI) with Lung Function Parameters in Non-asthmatics Identied by Spirometric Protocols. *J Clin Diagn Res*. 2014;8:12–14.
28. Collins LC, Hoberty PD, Walker JF, Fletcher EC, Peiris AN. The eect of body fat distribution on pulmonary function tests. *Chest*. 1995;107:1298–1302.
29. Cotes JE, Chinn DJ, Reed JW. Body mass, fat percentage and fat free mass as reference variables for lung function: effects on terms for age and sex. *Thorax*. 2001;56:839–844.
30. Bilgin, Cetin, Pulur. Relation between fat distribution and pulmonary function in triathletes. Ovidus University Annals, Series physical education and support / Science, Movement and Health ; 2010,.
31. Lazarus R, Sparrow D, Weiss ST. Effect of obesity and fat distribution on ventilatory function: the normative aging study. *Chest*. 1997;111:891–898.
32. Saxena Y, Sexena V, Divedi J, Sharma KR. Evaluation of dynamic function tests in normal obese individuals. *Indian J Physiol Pharmacol*. 2008;52:375–382.

Author biography

C Bharathi Assistant Professor

T Kannan Kumar Professor

R Niruba Associate Professor

Cite this article: Bharathi C, Kannan Kumar T, Niruba R. Correlation between PEFR and regional body fat in the middle aged male subjects – A cross sectional study. *Indian J Clin Anat Physiol* 2019;6(3):287-290.