ORIGINAL ARTICLE

Characteristics, predictors and prospects of lung function among male cigarette smokers in Sokoto Metropolis, North-West Nigeria

Muhammad D **ISAH**[1]
Muhammad A **MAKUSIDI**[1]
Aminu **ABBAS**[1]
Juliana U **OKPAPI**[2]
Chibueze H **NJOKU**[3]
Abdullahi A **ABBA**[2]

[1]*Department of Medicine Usmanu Danfodiyo University Teaching Hospital Sokoto NIGERIA*
[2]*Department of Medicine Ahmadu Bello University Teaching Hospital Zaria NIGERIA*
[3]*Department of Medicine University of Calabar Teaching Hospital Calabar, NIGERIA*

Author for Correspondence
Muhammad D **ISAH**
Department of Medicine
Usmanu Danfodiyo
University Teaching Hospital
PMB 2370, Sokoto, NIGERIA

Email: muzaifa2007@yahoo.com
Phone: ***+234 803 392 5238***

Received: August 18th, 2016
Accepted: September 20th, 2016

DISCLOSURES**:** NONE

ABSTRACT

Background: Cigarette smoking is a major risk factor for airflow limitation in addition to its other multi-systemic deleterious effects. Peak expiratory flow (PEF) measurement offers an opportunity to assess ventilatory function abnormalities in cigarette smokers.
Objective: The objective of this study is to determine ventilatory function using peak expiratory flow rate among adult male cigarette smokers in comparison with matched predicted value.
Methodology: This is a cross-sectional study among 150 current cigarette smokers aged 18-60years that were consecutively sampled in Sokoto metropolis. Peak expiratory flow was measured using Mini Wright's Peak Flow Meter and adapted questionnaire was used to record all measurements and relevant data. Comparison was made between the measured and predicted peak expiratory flow rate.
Result: A total of 150 male subjects who were predominantly below the age of 40years (76%) with mean age of 34.27±8.91years participated in this study. The mean pack-years and cigarette smoking index were 8.71±8.92 and 163.98±192.62, respectively. While the mean age of cigarette smoking commencement was 16.90±4.17years (9-36years).The mean measured PEF was 405.63±76.5 with the age group mean consistently decreasing with advancing age. Similarly, the difference between measured PEF and predicted PEF was significant and the magnitude of difference increased with advancing age. There was a negative correlation between PEF and pack-years smoked.
Conclusion: Cigarette smoking is associated with decline in ventilatory function. The intensity of cigarette smoking and advancing age were the main predictors that determine the airflow status among cigarette smokers.

Keywords: *Determinants, pack-years, tobacco use, ventilatory function*

INTRODUCTION

Cigarette smoking is a common social habit in the developed and developing countries despite its attendant multi-systemic deleterious effects. World Health Organization (WHO) report on global tobacco epidemic country survey revealed cigarette smoking prevalence of 17.4% and 1% among Nigerian males and females respectively.[1] Furthermore, WHO has estimated that tobacco use (smoking and smokeless) is currently responsible for the death of about six million people across the world each year with many of these deaths occurring prematurely.[1]

The numerous constituents of cigarette have been proven to have toxic and carcinogenic effect on lung tissues.[2,3,4] Worthy of mention is the fact that progressive decline in lung function is one of the common deleterious effect of cigarette smoking.[3, 4] The alteration in lung function is attributed to the chemical injury and inflammatory response of the lungs/airways to nicotine and other constituents of cigarette smoke.[4]

Tobacco smoking affects the lungs and airway among other multi-systemic involvement. Clinical manifestations of tobacco smoking on the respiratory system include; cough with or without expectoration, difficulty in breathing, noisy breathing and eventually decline in lung function.[4] The single most important risk factor for accelerated decline in lung function is cigarette smoking.[4] However, other risk factors which may act in concert with cigarette smoking include airway hyper-responsiveness, air pollution and occupational exposure to organic and inorganic dust.[4]

Peak Expiratory Flow Rate (PEFR) is one of the common lung function indices that is useful in detection, monitoring and prognostication of airflow limitation.[4,5] Measuring of PEFR has the advantage of being inexpensive, fast, sufficiently reproducible and reliable test of lung function. Noteworthy, is the demonstrable effect of cigarette smoking on the lungs/airway which result in alteration of PEFR.[4, 6,7,8]

The objective of this study is to assess characteristics, predictors and prospect of peak expiratory flow rate among cigarette smokers. The outcome would validate the ability of PEF to detect, and prognosticate airflow limitation. Furthermore, communication of result of PEFR to study participants may inform cigarette smoking cessation decision and limit morbidity and mortality.

In view of the rising incidence of tobacco smoking related illnesses, especially Chronic Obstructive Pulmonary Disease (COPD), it will be prudent if the affected patients are detected early and managed.[4] This is important because, currently there is no treatment that can reverse the natural history of airflow limitation in the advanced stage.

Furthermore, early stage airflow limitation is neither appreciated by the subject, nor readily recognized by the health care providers clinically. Symptomatic patients may also adapt to their condition or neglect their symptoms. When case finding is limited to symptomatic smokers, there may be the risk of missing quite a significant number of subjects who are at risk of developing airway obstruction. All these facts emphasize the need for better ways by which tobacco smoking-related diseases can be detected early.

This work is justified by the dearth of published studies which have attempted to assess ventilatory function of cigarette smokers using peak flow meter in Nigeria. It is a pioneer study that has attempted to identify the ventilatory function predictors of cigarette smokers.

METHODOLOGY

This is a cross-sectional study conducted in Sokoto metropolis , Sokoto State, North-West

Nigeria, after obtaining ethical approval from the Ethics and Research Committee of Usmanu Danfodiyo University Teaching Hospital, Sokoto.

One hundred and fifty healthy adult male subjects who were active cigarette smokers (someone who at time of the study had smoked at least 100 cigarettes and still smokes every day or on some days) and within the age bracket of 18-60years were recruited through consecutive non-probability sampling technique after giving written consent.[9] Subjects with chest deformity, previous pulmonary surgery and any illness that would affect performance of ventilatory function test were excluded.

The subjects recruited were administered a questionnaire partly adapted from the European Community Respiratory Health Survey questionnaire to record their identification, demographic data, duration of cigarette smoking, quantity of cigarette smoked (pack-years and smoking index) and other clinical evaluation details.[10] The weight (using Hana mechanical Weighing scale, model BR9012) and height (using Seca Freestanding Mobile Stadiometer) of the subjects were measured to the nearest 0.1kg and 0.1cm, respectively.

Peak expiratory flow was measured using Wright's mini Peak Flow Meter (Standard range peak flow meters, code no-3103387, Clement Clark). The details of PEF measurement was explained and demonstrated to the subjects. Furthermore, participants practice the procedure satisfactorily and all doubts if any were clarified. All measurements were taken between 0700-1200HOURS in standing position and with a nose clip. The best of three PEF readings that achieved at least a grade B American Thoracic Society criteria was chosen for analysis.[11] Regression equation obtained by using a curvilinear formulae and representative of the subject under study was used to obtain the predicted PEF values for each of the subjects.[12]

The data collected were analyzed using Statistical Package for Social Sciences version 19 (IBM SPSS version 19, SPSS Inc, Chicago, IL60606-6307, USA). Mean±standard deviation was calculated for age, weight, height and BMI. Paired t-test was used to compare means of numerical variables. The relationship between pack years and PEF was tested using Pearson product moment correlation coefficient. Multiple linear regression was used to identify predictors of PEF decline. Statistical significance was specified by *'p' value <0.05.*

RESULT

A total of 150 male subjects with mean age of 34.27±8.91 participated in this study. The youngest and oldest participants in this study were aged 20years and 58years, respectively. One hundred and fourteen subjects (76%) were <40years of age. The mean pack-years of cigarette smoking was low (8.71 ± 8.92). Table 1 depicts the anthropometric and socio-demographic characteristic of the participants

The mean age of cigarette smoking commencement was 16.90±4.17years (9-36 years). The mean pack-years and cigarette smoking index were 8.71±8.92 and 163.98±192.62, respectively. Daily cigarette stick smoked increased from initial value of 3.69 to current value of 13.29. Other smoking characteristics among study subjects are displayed in Table 2.

The mean PEFR decreases with advancing age with the ≤29year and ≥ 50year groups having mean PEFR of 413.82 and 320.45, respectively. Comparison of measured PEFR and Predicted PEFR was significant in all age groups (*p<0.001*).

The age, height and pack-years were better predictors of PEFR at *p-value* of 0.05, *see Table 4.*

Table 1. Anthropometric and socio-demographic parameters of study participants

Anthropometric/ socio-demographic parameters	Frequency (%)	Mean (SD)
Age (years)		**34.27 (8.91)**
≤ 29	51 (34.0)	
30-39	63 (42.0)	
40-49	25 (16.7)	
≥ 50	11 (7.3)	
Weight (kg)		**64.92 (10.10)**
≤ 50	11 (7.3)	
51-60	45 (30.0)	
61-70	60 (40.0)	
71-80	22 (14.7)	
81-90	9 (6.0)	
≥ 91	3 (2.0)	
Height (meter)		**1.69 (0.10)**
≤1.50	3 (2.0)	
1.51-1.60	23 (15.3)	
1.61-1.70	53 (35.3)	
1.71-1.80	62 (41.3)	
≥ 1.81	9 (6.0)	
Pack years		**8.71 (8.92)**
≤ 10	110 (73.3)	
11-20	25 (16.7)	
21-30	10 (6.7)	
31-40	0 (0.0)	
41-50	1 (0.7)	
51-60	0 (0.0)	
61-70	3 (2.0)	
≥ 71	1 (0.7)	

Table 2. Smoking characteristics of study subjects

CHARACTERISTICS	VALUE Mean±SD
Age at cigarette smoking onset (yrs)	16.90±4.17
Initial daily cigarette number	3.69±2.59
Current daily cigarette number	13.29±10.28
Pack years	8.71±8.92
Smoking index	163.98±192.62
Smoking duration (Years)	17.36±8.45

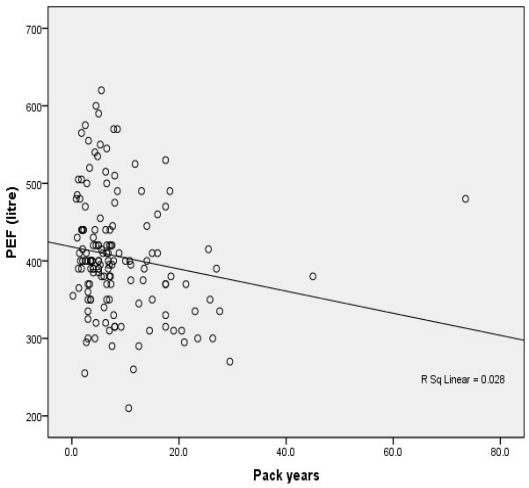
Table 3. Peak expiratory flow rate result of cigarette smokers by age group and predicted values

Age group (years)	Measured PEFR(litre) mean (SD)	Predicted PEFR[a] (litre) mean (SD)	p value
≤ 29	413.82 (66.4)	446.92 (22.6)	<0.001
30-39	413.06 (67.1)	439.36 (26.8)	<0.001
40-49	381.40 (68.7)	415.84 (29.8)	<0.001
≥50	320.45 (52.9)	376.82 (25.5)	<0.001
Total	405.63 (76.5)	433.42 (32.0)	<0.001

Table 4: Multiple linear regression analysis of PEFR

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	**(Constant)**	159.114	119.745		1.329	.186
	Age (years)	-2.042	.828	-.238	-2.466	.015
	Weight (kg)	.531	.593	.070	.894	.373
	Height (meter)	170.613	71.624	.185	2.382	.019
	Pack years	-7.204	2.215	-.840	-3.252	.001

Figure 1. Correlation between PEFR and Pack years



The best line of fit for the relationship between pack-years and PEFR shows a negative correlation (r^2=*0.028*).

DISCUSSION

The subjects in our study were predominantly young (<40 years) constituting 76% of the study participants. This is probably due to early indulgence in cigarette smoking habits.[13,14] Our findings are similar to those by Hammad, *et al,* who observed that 64 subjects (64%) in their study were below the age of 40years.[15] Ours, however, contrasts with the hospital-based study by Mistry, *et al,* whose participants were majorly middle or advanced age cigarette smokers.[16]

Our finding of low mean pack-years and mean smoking duration may not be unrelated to the predominantly young age of our study participants. This finding is in accordance with the result in Tikrit and Ahmedabad, in which 66% and 80.1%, respectively, of the study participants smoked less than a packet of cigarette daily.[15,17] However, other studies reported higher pack-years among study participants.[7,18]

The mean measured PEFR (405.63 ±76.5) from our study is comparable to those in the studies by Chauhan, *et al,* and Tambi, *et al*.[7,18] A significant difference between measured PEFR and predicted PEFR was observed in our study and this difference increased with advancing age.

Furthermore, it suggests that age could have contributed significantly to the extent of decline observed in addition to that attributed to cigarette smoking. The disparity in the measured and predicted PEFR re-emphasizes the airflow limitation attributable to inflammatory effect of cigarette smoke content on the airway that culminates in the decline of ventilatory function among cigarette smokers.[2,3,4] Other studies have obtained similar results in Gujarat, Rajasthan, Tunisia and Ahmedabad.[15,18,19,20]

The number of pack-years smoked in our study had a significant effect on the PEFR (r = - .166). This relationship is attributable to the adverse effects of cigarette smoke on the airway which result in wall thickening, airway narrowing and deformity with airflow limitation.[3,4] Our results concur with those from Saad, *et al,* and Chauhan, *et al*, who in their studies similarly demonstrated a negative correlation between pack-years smoked and PEFR.[18,20] The difference in magnitude of correlation in the index study (weak negative correlation) as compared to our studies may be related to the predominantly young study population with low mean pack-years and smoking duration. The findings by Kiter, *et al*, differ with our result on the basis that they got an insignificant correlation between cigarette use and PEFR which they attributed to a problem with quantification of narghile (water-pipe tobacco smoking).[21]

The ventilatory function of cigarette smokers decline over time but, there is no consensus on the timing, susceptibility and determinants. Our finding that pack-years is the main predictor of decline in PEFR is consistent with previous studies.[15,18] Similarly, multiple linear regression from this study additionally suggested that age is a predictor of airflow limitation and this finding is in tandem with the result of the study by Paula, *et al*.[22]

CONCLUSION

The PEFR is low among cigarette smokers. This is probably due to the deleterious effects of

cigarette smoke on the airway. A decline in PEFR among cigarette smokers correlated with advancing age and intensity of cigarette smoking. The absolute PEFR values are low in comparison with values obtained using prediction formulae for age, height and weight.

REFERENCES

1. WHO global report on trends in prevalence of tobacco smoking 2015, Available at:apps.who.int/iris/bitstream/10665/156262/1/9789241564922_eng.pdf(Accessed: 17/09/2016).
2. Newcomb PA. The health consequences of smoking cancer. *Med CI North Am* 1992; 76: 305-331.
3. Office of the US Surgeon General. The Health Consequences of Smoking: A report of the Surgeon General. Centers for Disease Control and Prevention (CDC), Office on Smoking and Health 2004. Available at: http//www.surgeongeneral/gov/library/reports/smoking consequences. (Accessed: 13/05/2012).
4. Global Initiative for Chronic Obstructive Lung Disease (2006) Global Strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. Available at: http//www.goldcopd.org/guidelineitam.asp. (Accessed: 20/08/2012).
5. Llewellin P, Sawyer G, Lewis S, *et al.* The relationship between FEV_1 and PEF in the assessment of the severity of airways obstruction. *Respirology* 2002; 7(4):333–337.
6. Gokuldas VS, Saurabh RK, Prashant RK. Effect of smoking on PEFR: a comparative study among smokers and non-smokers in an urban slum community of Hyderabad, *India. Int J Community Med Public Health* 2016; 3(1):246-250.
7. Medabala T, BNR, Mohesh MIG, Kumar MP. Effect of Cigarette and Cigar Smoking on Peak Expiratory Flow Rate. *J Clin Diagn Res* 2013; 7(9): 1886–1889.
8. Ukoli CO, Joseph DE, Durosinmi MA. Peak Expiratory Flow Rate in Cigarette Smokers. *Highland Medical Research Journal* 2002; 1(2): 36-37.
9. Centers for Disease Control and Prevention. State specific second hand smoke exposure and current cigarette smoking among adults in United States. *Morb Mortal Wkly Rep* 2008; 58:1232-1235.
10. European Community Respiratory Health Survey II main Questionnaire. Available at: www.ecrhs.org/ECRHS%20I/main%20questionnaire. Accessed: 16/07/2013.
11. American Thoracic Society. Lung function testing: selection of reference values and interpretative strategies. *Amer Rev Respir Dis* 1991; 144:1202–1218.
12. Njoku CH, Anah CO. Reference value for peak expiratory flow rate in Adults of African descent. *Tropical Doctor* 2004; 34:135-140.
13. Raji MO, Abubakar IS, Oche MO, *et al*. Prevalence and determinants of cigarette smoking among in school adolescent in Sokoto metropolis, North West Nigeria. *International Journal of Tropical Medicine* 2013; **8**:81-86.
14. Awosan KJ, Ibrahim MTO, Sabir AA, *et al*. Awareness and Prevalence of risk factors of coronary heart disease among Teachers and Bankers in Sokoto, Nigeria. *Journal of Medicine and Medical Sciences* 2013; 4:335-342.
15. Hammad AQ, Jamil AS, Tahira KS, *et al*. Spirometric screening of chronic obstructive pulmonary disease in smokers presenting to tertiary health care. *J Medicine* 2009; 10:40-44.
16. Mistry A, Tyagi R, Kagathara J, *et al.* Comparative Study of Pulmonary Function Tests in Smokers and Non-Smokers. *GCSMC J Med Sci* 2014; 3:22-27.
17. Abdulrahman WF. Effect of smoking on Peak Expiratory Flow Rate in Tikrit University. *Tikrit Medical Journal* 2011; 17:11-18.
18. Chauhan S, Mehta P, Suhalka ML, *et al.* Effect of Cigarette Smoking on Peak Expiratory Flow Rate. *GJB* 2014; 3:398-401.
19. Karia RM. Comparative study of peak expiratory flow rate and maximum voluntary ventilation between smokers and non-smokers. *National Journal of medical Research.* 2012; 2:191-193.
20. Saad HB, Khemis M, Bougmiza I, *et al*. Spirometric profile of narghile smokers. *Revue des Maladies Respiratoires* 2008; 28: e39-e51.
21. Kiter G, Ucan ES, Ceylan E, *et al*. Water-pipe smoking and pulmonary functions *Respir Med* 2000; 94:891-894.
22. Paula R, Timo H, Vuokko K. The use of microspirometry in detecting lowered FEV_1 values in current or former cigarette smokers. *Primary care Respiratory Journal* 2008; 17:232-237.