

Study of Peak Expiratory Flow Rate and Blood Oxygen Saturation in Female Beedi Rollers

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Abstract:

Background: Beedi rolling is one of the largest small scale industries in India providing employment to millions of women having low socioeconomic status. They are constantly exposed to tobacco dust and its alkaloids which results in various respiratory complications.

Aims & objectives: To assess the effect of tobacco exposure and its duration on Peak expiratory flow rate (PEFR), Blood oxygen saturation (SpO₂) and Pulse rate (PR) using Wright's peak expiratory flow meter and pulse oximeter in female beedi rollers.

Materials & methods: The study was conducted in non communicable disease out patient department of Tirunelveli Medical College Hospital, Tirunelveli. Fifty female beedi rollers after answering a simple questionnaire, the above parameters were recorded & and the results were analysed by appropriate statistical software.

Results: In these study subjects, PEFR was below the normal range (300 -500 L/min) SpO₂ & PR showed a mild variation.

Conclusion: Females with tobacco exposure more than 20 years show a significant reduction in PEFR.

Keywords: Beedi rollers, Peak expiratory flow rate, Blood oxygen saturation , Pulse oximeter.

I. Introduction

Beedi is a thin South Asian cigarette made of 0.2 - 0.3 g of tobacco flakes wrapped in a tendu (*Diospyros melanoxylon*) leaf & secured with coloured threads at both ends (1). Beedi rolling is manual, homebased, mostly comprises of women ,working in poor unhygienic environment . The government estimates 4.4 million workers in beedi rolling industries. (2). These people are constantly exposed to raw tobacco and its alkaloids through cutaneous and pharyngeal routes resulting in giddiness, musculoskeletal pain and lung diseases like asthma, tuberculosis, bronchitis etc..(3,4) .Continuous exposure to tobacco processing environment reduces the workers lung volume and peak expiratory flow rate resulting in respiratory symptoms like cough , chest tightness, breathlessness and pulmonary symptoms like chronic obstructive pulmonary disease (COPD) (5,6). Because of continuous and prolonged duration of exposure to that dust women are more vulnerable to health risks associated with beedi rolling (7,8)

II. Aims And Objectives

To determine the Peak expiratory flow rate (PEFR) & blood oxygen saturation (SpO₂) & pulse rate (PR) in female beedi rollers. To evaluate the effect of tobacco exposure and its duration on PEFR, SpO₂, PR.

III. Materials And Methods

The study was conducted in non communicable disease out patient department (OPD) between 10AM - 12 noon at Tirunelveli Medical College Hospital, Tirunelveli . Institutional Ethical Committee approval was obtained. **Study design:** Healthy female beedi rollers who were attending the OPD for some other causes were recruited by random sampling technique . Inclusion criteria : Cooperative healthy female beedi rollers of age group 20-40 years having 20yrs & more than 20 years of tobacco exposure . They are divided into 2 groups based on their years of exposure (< 20 yrs & ≥ 20yrs).

Exclusion criteria: Diabetes, Hypertension, chest pain or abdominal pain of any cause, recent myocardial infarction , stress incontinence, malignancy, pregnancy, pre existing COPD. The informed and written consent were obtained after explaining the procedure to the subjects. In the beginning of study, simple questionnaire (St.George's Respiratory Questionnaire) were asked in these subjects concerning with their age, duration of respiratory problems & duration of tobacco exposure etc. Studies proved that PEFR is a single best test to assess ventilatory efficiency and it is the maximum flow rate during a single forced expiration (9). Pulseoximeter is a simple, reliable technology that detect pulsatile signal in an extremity such as finger or toe and can calculate the amount of oxygenated hemoglobin or blood oxygen saturation (SpO₂) and pulse rate (PR).

PEFR was measured using Wright’s peak expiratory flow meter.

The precaution undertaken while recording PEFR are

1. Indicator of flow meter was kept at the bottom of scale.
2. The subject was asked to sit comfortably in erect posture.
3. The disposable mouth piece was used.
4. A demonstration of PEFR was done before using the flow meter.
5. The subject was instructed to take a deep breath and blow into the peak flow meter as quickly as possible
6. PEFR was done for 3 times and the best of the three (highest effort) was recorded.

Simultaneously blood oxygen saturation and pulse rate were recorded using pulse oximeter (BPM-200-Biosys) The readings obtained through pulse oximetry, uses a light sensor containing two sources of light (red & infra red) that are absorbed by hemoglobin and transmitted through tissues to a photodetector. The amount of light transmitted through the tissue is then converted to a digital value representing the percentage of hemoglobin saturation. So the sensor device is placed around the pulsating arteriolar bed of finger (eg. left or right index) and the SpO2 & pulse rate were recorded. Datas were analysed using appropriate statistical software (SPSS - 16)

IV. Results

Table : 1

**MEAN VALUES OF PULSE RATE , SpO2 , PEAK EXPIRATORY FLOW RATE
N=50 FEMALES , AGE = 20-40 YRS**

DURATION OF TABACCO EXPOSURE	MEAN PULSERATE /MIN	MEAN SpO2 %	MEAN PEFR LITRE / MIN
< 20 YRS (N=23)	78.26	98.04	354.70
> 20 YRS (N=27)	81.74	96.11	260.70

Normal values

PEFR = 300-500 L/min (avg. 350)

PR = 65-75 / min (avg. 70)

SpO2 = 94 - 99 % (avg. 98%)

Table: 2 Karl Pearson Correlation

	Duration	PEFR	Pulse	SPO2
Duration	1.000	-.951**	-0.157	-0.300*
PEFR		1.000	0.113	0.238
Pulse			1.000	-0.219
SPO2				1.000

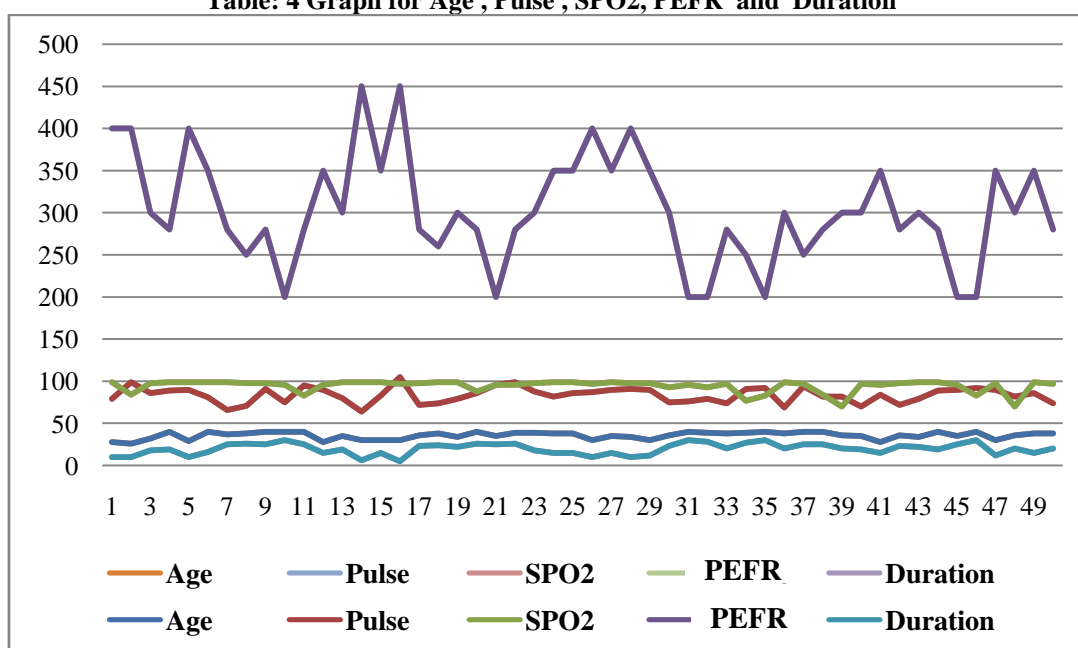
** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

Table: 3 One-Way ANOVA – Duration and Other Variables

		Sum of Squares	Df	Mean Square	F	Sig.
Age	Between Groups	584.429	16	36.527	4.599	.000*
	Within Groups	262.071	33	7.942		
	Total	846.500	49			
Pulse	Between Groups	2104.778	16	131.549	2.171	.029
	Within Groups	1999.302	33	60.585		
	Total	4104.080	49			
SPO2	Between Groups	1059.068	16	66.192	1.349	.227
	Within Groups	1619.352	33	49.071		
	Total	2678.420	49			
PEFR	Between Groups	193032.476	16	12064.530	38.693	.000*
	Within Groups	10289.524	33	311.804		
	Total	203322.000	49			

Table: 4 Graph for Age , Pulse , SPO2, PEFR and Duration



V. Discussion

The World health organization, (WHO) estimates occupational health risks as the tenth leading cause of morbidity and mortality. Beedi industry is entirely a home –based industry in India which employs over 4 million people, the majority being women (10). They have been constantly exposed to raw tobacco. Chronic and prolonged exposure is similar to passive smoke / environmental tobacco exposure which leads to some of some detrimental effects resulting from active smoking (11). The long term exposure to tobacco dust cause respiratory & allergic problems (12,13,14,15). Hence to assess the overall ventilatory lung function, blood oxygen saturation & pulse rate, Wright ‘s peak flow meter & Pulse oximeter were used in this study.

Table: 1 shows the mean values of PR, SpO2 & PEFR and also significant reduction in PEFR (260 litre / min) in females who were exposed to tobacco for more than 20 years (16). The average PEFR of healthy young Indian females is about 350 litre / min. Reduction in PEFR is due to airflow obstruction since the mucociliary system of respiratory passages are affected by irritants (tobacco dust & flakes), which results in narrowing of respiratory passages & increase in airway resistance leading to bronchoconstriction , inflammation of bronchial walls & increased secretion of mucus (11). Our study correlates with the findings of Gupta P etal (1999) whose reports show reduction in PEFR is due to exposure of individual to various kinds of dusts. (17)

Table: 2 shows the effect of duration of tobacco exposure on PEFR , SpO2 , PR using Karl Pearson Correlation and PEFR decreases with increase in duration of exposure was found to be statistically significant ($p < 0.01$). Variation of SpO2 & PR with the duration of exposure found to be less significant ($p < 0.05$). Nicotine, an alkaloid present in tobacco leaves, doesn’t cause directly tobacco related diseases, but it is an addictive. It binds to the brain receptors & through release of catecholamines, it causes increase in heart rate , blood pressure & cardiac output (11). Blood oxygen saturation (SpO2) obtained by pulse oximetry are one part of a complete assessment of the subject’s oxygenation status and are not a substitute for measurement of arterial partial pressure of oxygen (PaO2) or of ventilation. In this study SpO2 shows a mild variation ($p < 0.05$) . Pulse rate found to be normal or slightly increased. Mild variation in blood oxygen saturation is due to airflow obstruction which correlates with the findings of Chattpadhyay etal who says that respiratory impairments of restrictive , obstructive & combined restrictive & obstructive type seen among tobacco exposure (18) .The findings also correlate with Mukhtar MS etal who says mostly small airways are affected much by exposure to tobacco (19).

Table: 3 shows the variation of age , pulse rate , SpO2 , PEFR with duration of exposure using One Way Anova test. The age and PEFR show statistically significant variation (0.000*) with the duration of exposure PEFR show a decline with advancement of age (20). Previous studies have shown that senile degerative changes in lungs such as loss of respiratory muscle strength, stiffness of joint movements are probably the most important factors reducing lung function with advancing age. These factors also limit the ventilator function & thus cause reduction in total lung capacity & PEFR (21, 22). As age advances there is oxidative damage leads to decreased elastic recoiling of lungs , loss of chest wall compliance & reduced diaphragmatic efficiency (23, 24) Table :4 shows a graphic representation of variation of age, pulse rate , SpO2, & PEFR with the duration of tobacco exposure . Among all, PEFR show significant reduction with duration of exposure. According to Hankinson J.L

etal , who measured serial PEFR in persons exposed to workplace environment & documented changes in lung function (25). Long term exposure to particulate matter has serious effects on health like asthma, tuberculosis, bronchitis, chronic obstructive pulmonary diseases, cervical spondylosis, mensural problems, miscarriages ,breast cancer etc.. (26) and short term exposure has few illness like weakness of eyes , backache, headache , loss of weight, cough, breathlessness, finger numbness, loss of appetite, cutaneous manifestations, nausea, tiredness, fatigue (27,28)'

VI. Conclusion

The values of Peak expiratory flow rate , blood oxygen saturation & pulse rate show variation with the duration of exposure . Female beedi rollers with exposure greater than 20 years show significant reduction in PEFR .So these exposures can be prevented to some extent by wearing protective clothes , masks & gloves during beedi rolling.

Limitations: This study can be done in large samples & for longer duration . Should have a follow up after preventive measures in future.

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