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Research Article

Pulmonary Functions among Beedi Rolling Workers of South India - A Cross Sectional Study

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Abstract

Background: In India, 1.83 million people are suffering from occupational diseases contributing to 20% of the global burden. Prevalence of respiratory impairment amongst beedi workers in India is 23.5%. Prolonged exposure to low levels of tobacco dust may lead to respiratory impairment thereby affecting the lung functions. Hence, this Cross sectional study was conducted.
Objective: To evaluate the pulmonary functions (PFT) of beedi workers and to assess the gender variation and the association of duration of exposure to tobacco dust.
Methods: This cross sectional study included Beedi rolling workers (n=182) from different areas of Salem and Dharmapuri exposed to raw tobacco. Both sexes of age 20 to 50 years and who were involved in beedi rolling for at least for >2yrs were included in the study. Data were collected with a self administered questionnaire, and with a flow volume spirometry. Pulmonary function test was done and bronchodilator reversibility was done to arrive at a diagnosis. Data was analysed using SPSS software 18.0.
Results: The tobacco workers tended to have a low forced vital capacity (FVC), and they had impaired Forced expiratory volume in 1 second (FEV1) and lower means of the maximal expiratory flow at 25% of the FVC significantly. Point prevalence of pulmonary functions revealed combination of obstructive (16%), restrictive (7%), and mixed (10%) disorders. Tobacco workers exposed to tobacco dust for longer duration (>11 years) had significant reduction of FVC, FEV1 and FEV1/FVC.
Conclusion: This study shows respiratory impairment amongst beedi workers who are exposed to tobacco dust which emphasise on strict preventive measures to be adopted.
Key words: Beedi Workers, Pulmonary functions, South India, Occupational exposure, Tobacco dust

1. Introduction

Beedi making is the one of the largest small scale industry in India giving employment to millions of men, women and children of the lower socio-economic strata, primarily dominated by home workers.

A beedi is a thin South Asian cigarette made of 0.2-0.3 g of tobacco flake wrapped in a tendu (*Diospyrox melanoxylon*) leaf and secured with thread at both ends. Consumption of beedi is more among people of lower socioeconomic strata which carry greater health risk as it delivers more nicotine, carbon monoxide and tar than conventional cigarettes. As per Tobacco Institute of India[1], 3s5 million people are involved in tobacco industry which includes 6 million farmers, 20 million farm workers, 4.4 million beedi workers, 2.2 million tendu leaf pluckers and 2 million traders. Although, the trade unions and private organisations say that the actual number of beedi workers is much higher, as there are many unregistered workers in India.

Health hazards associated with occupational exposure to tobacco was initially reported by Mc Cornick *et al*[2] in 1948. Studies from India as well as from other countries have shown increased occurrence of respiratory disorders such as emphysema, chronic bronchitis, and occupational asthma and several other ailments such as skin diseases, gastrointestinal illness, gynaecological problems, lumbosacral pain in tobacco workers[3-7]. Few studies have shown both restrictive and obstructive patterns among beedi industry workers[8].

There are limited studies available on beedi workers in Tamilnadu, hence this study was proposed to evaluate the pulmonary functions among beedi workers of selected districts of Tamilnadu and also to examine the decrements in pulmonary functions with increasing years of exposure to tobacco dust.

2. Materials and Methodology

2.1 Subjects

This cross sectional study was planned at Department of Physiology Sri Ramachandra University, Porur, Chennai and conducted amongst beedi workers (n=182) in Salem and Dharmapuri districts of Tamilnadu over one year and four months duration between September 2010 to January 2012. The subjects selected were from southern and central part of Salem and widely distributed areas of Dharmapuri district employed at four private beedi industries.

Study subjects included were both men and women in the age group of 20-50 years rolling beedis at home and also the workers at beedi industry. Institutional Ethical Committee clearance was obtained prior to the onset of the study. Informed consent was obtained from the subjects after explaining the protocol and the benefits of the study to them.

Tobacco workers were selected from the industries based on the inclusion criteria and exclusion criteria. The Inclusion criteria included a) Working in tobacco industry for ≥ 2yrs and b) Exposed to tobacco dust > 8hours a day and Exclusion criteria included (1) Any recent acute respiratory illness (within 1week) (2) History of recent abdomino thoracic surgeries or eye surgeries (3) Subjects with active tuberculosis (4) Pregnancy (5) Congenital cardio pulmonary disorders.

2.2 Data collection

Demographic details, socio economic status, nutritional status, occupational history, smoking history and history of respiratory illnesses were collected using a validated structured questionnaire. General examination and detailed respiratory system examination was performed and the clinical examination findings were recorded. The standing height in centimeters and weight was recorded in Kilograms. Body mass Index was calculated by using the formula: BMI = Weight (in Kg)/Height in meter^2 (Quetelet's Index). Pulmonary function tests (PFT) namely Forced Vital Capacity (FVC),Forced Expiratory Volume in one second (FEV1), Forced Expiratory Volume in one second (FEV1) and Forced Vital Capacity (FVC) ratio (FEV1 /FVC) ,Forced Expiratory Flow Rate 25-75% (FEF25-75%) and Peak Expiratory Flow Rate (PEFR) were measured using portable data logging Spirometer (KOKO Spirometer).

2.2.1 Pre test: The subjects were asked to avoid vigorous physical exercise for at least one hour prior to the test. They were made to wear comfortable clothing. Subjects were informed not to take short-acting bronchodilators at least four hours prior to the test. The test was not performed for at least two hours after consumption of a large meal.

2.2.2 Spirometry: The procedure for performing spirometry was explained in detail to the subjects and they were seated in a chair and nose clips were used to prevent air leakage from the nostrils. Subjects were instructed to take a large breath to full inspiration through the mouth. He / she was instructed to breathe out hard and quickly for atleast 6 seconds until all the air is expelled. At least 30s was left between blows (exhalations using the spirometer) to enable the patient to recover. A minimum of three and a maximum of eight blows were attempted. One of the best from three readings was taken for final data analysis. The shapes of the flow/volume loop or volume/time curves were observed to detect poor effort. A bronchodilator reversibility test was done in subjects having FVC, FEV1 and FEF 25-75 % to be less than 80 % of the predicted value. Two puffs of beta 2 selective sympathomimetic drug (salbutamol 100 mcg) were administered through oral inhalation and after 15 minutes spirometry were repeated. Pre/post graph comparison was done to assess the effectiveness of the bronchodilator. If two out of three measurements (FVC, FEV1 and FEF25% - 75%) were improved after the administration of inhalational bronchodilator, then it was considered that the patient had a reversible airway obstruction that was responsive to bronchodilator medication. Predicted pulmonary functions of the workers were derived using the predicted equations and was compared with their observed values.

2.3 Statistical analysis

Data analysis was performed with SPSS software version 18.0. Prevalence was expressed in terms of percentage. Student't' test was used to compare the pulmonary functions between male and female beedi workers and also to compare the lung functions with the different duration of occupational exposure to tobacco dust. P value less than 0.05 was considered for statistical significance.

3. Results

A total of 275 domestic beedi rolling male and female workers were screened for this study. Out of 275 subjects, only 182 subjects were finally selected for the study after excluding PFT with poor efforts, with history of recent abdominal surgery and respiratory tract infections. Out of the 182 workers, 80 were male beedi workers and 102 were female beedi workers. Depending on the years of exposure to tobacco dust, the subjects were broadly classified into 2 categories: Category 1: 2-10yrs of exposure (n=145) and Category 2: 11-30 yrs of exposure (n=37).

Table 1: Description of the anthropometric parameters of both male and female beedi industry workers of the study population

Parameters	Males (n=80)	Females (n=102)
Age(yrs)	37.2±7.3	32.3±7.1
Height (cms)	162.6±6.6	152.0±3.8
Weight (kgs)	62.7±10.1	55.3±7.8
Body mass index (kg/m^2)	23.6±3.2	23.9±3.0

Data expressed as mean ± SD. Comparison was done using independent 't' test

Body mass index between males and females was similar and majority of the workers were well nourished.

Table 2: Comparison of pulmonary functions among male and female beedi workers

Pulmonary functions	Males (80)	Females (102)
FVC (L)	2.8±0.5	2.48±0.3*
FEV1 (L)	2.4±0.4	2.17±0.2*
FEV1/FVC (L)	0.8±0.04	0.8±0.04*
PEFR (L/Sec)	6.7±1.1	5.5±0.9*
FEF 25-75(L)	3.3±0.4	3.0±0.3*

FVC-Forced vital capacity, FEV1-Forced expiratory volume in one second, PEFR-Peak expiratory flow rate, FEF 25-75-Forced expiratory flow rate 25-75%.

Data expressed as mean ± SD. Comparison was done using independent t test, *P value <0.05.

Pulmonary functions were significantly higher in males than females which are due to physiological factors especially greater height and weight. The observed pulmonary function parameters were significantly lower than their predicted values that were calculated using the south Indian specific predicted equation.

Table 3: Comparison of pulmonary functions of two groups categorized based on duration of exposure

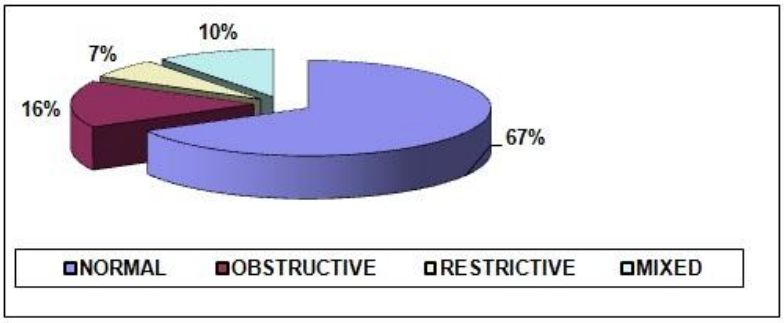
Pulmonary Functions	2-10 yrs of exposure to tobacco dust (n=145)	11-30 yrs of exposure to tobacco dust (n=37)
FVC (L)	2.7±0.4	2.3±0.3*
FEV1 (L)	2.3±0.3	2.1±0.3*
FEV1/FVC (L)	0.8±0.04	0.8±0.07*
PEFR (L/Sec)	6.1±1.1	5.6±1.2*
FEF 25-75(L)	3.2±0.4	2.9±0.5*

FVC-Forced vital capacity, FEV1-Forced expiratory volume in one second, PEFR-Peak expiratory flow rate, FEF 25-75-Forced expiratory flow rate 25-75%.

Data expressed as mean ± SD. Comparison was done using independent t test, *P value <0.05.

Table No.3 shows workers working in beedi industry for more than 11 years showed a significant decrease in their pulmonary functions except PEFR and FEF 25-75%, proving that the smaller airways are more affected due to chronic exposure to tobacco dust. Pulmonary functions declined with increasing years of exposure.

Figure 1: Graph showing Point prevalence of pulmonary patterns among beedi industry workers (n=182)



Pie graph shows the distribution of respiratory patterns in beedi workers 16% of workers had obstructive, 7% had restrictive and 10% of workers had mixed respiratory disorder which was inferred based on based on the spirometry data.

4. Discussion

This study conducted in beedi making workers of selected districts of Tamilnadu exposed to tobacco dust and flakes at the work place, has shown significant decline in the pulmonary functions of these workers with increasing years of exposure. Studies have shown that tobacco workers exposed to tobacco dust for longer duration (>11 years) had significant reduction of lung functions. The damp environment the workers work in and the fungi contaminated tobacco leaves are known to increase the risk of acute bronchitis, chronic bronchitis, allergic asthma, and extrinsic alveolitis[7]. Malson *et al*[9] showed that these tobacco-processors were exposed to extremely high levels of inspirable tobacco particulates. Tobacco dust contains various immunologically active and toxic substances. It has been established that occupational chronic exposure to the dust of tobacco leaves is associated with significant increase in the occurrence of respiratory disorders[8, 10, 11].

Pulmonary functions compared between smokers and non smokers did not show any significant decrease among smokers probably in this study, although smoking is very well known risk factor for lung function decrement. The lack of evidence in this study could be because of less number (n= 20) of smokers in this study population. Smoking is an additional risk factor among male beedi workers which makes them more susceptible to respiratory ailments[8].

16% of workers had obstructive, 7% had restrictive and 10% had mixed type of ventilatory defect. Study conducted by B.P Chattopadhyay *et al*[8] have reported similar observations. X –ray chest confirmed lung parenchymal changes have also been reported among workers exposed to tobacco dust for more than 30years[12].

Considering the high content of nicotine and other chemicals in beedi, these workers are also at a high risk of developing other systemic illness. The mechanistic pathways such as airway inflammation, oxidative stress and allergic mechanisms etc involved in the development of respiratory impairments needs to elaborate further by conducting in-vitro studies.

Beedi making is a highly intensive and laborious activity with minimal sophisticated manufacturing techniques. Several private organizations and trade unions have reported that majority of these beedi making industries are unregistered and workers do not use any personal protective equipment.

The limitation of this study is that the exact causation could not be established as it is cross sectional study and tobacco dust concentration in working places was not measured. Although the causation has not been established in this study, the findings clearly indicates decline in lung functions among beedi workers which warrants implementation of preventive measures in this sector such as engineering controls to reduce the exposure, promotion of usage of personal protective equipments and periodic medical surveillance. The results of this study can be used as pre intervention baseline data for assessment of efficacy of interventions in this geographical region which is one of the major hub in India.

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