Article

FVC, FEV_1 and FEV_1% in Male Tobacco Industry Workers

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Abstract

Background: Tobacco industry workers are exposed to tobacco dust and smoke in their work places. Usually they have varying degree of impaired pulmonary functions, but the level of awareness about this occupational hazard among the tobacco industry workers and authorities are limited. **Objective:** The present study was conducted to observe the effects of exposure to tobacco dust and smoking on FVC, FEV_1 and FEV_1%. **Methods:** This cross-sectional study was carried out in the Department of Physiology, Rangpur Medical College, Rangpur, from July 2008 to June 2009 on 50 apparently healthy male smoker (Group B) and 40 non-smoker (Group C) tobacco industry workers with age range 20 to 45 years. For comparison,50 age and body surface area matched apparently healthy male non-smoker non-tobacco workers were also studied as Control(group A). The study groups were selected from different tobacco industries of Rangpur district and control group were selected from the surrounding community who belonged to lower socioeconomic condition. Pulmonary function parameters were measured by digital spirometer. Statistical analysis was done by unpaired't' test . **Results:** Smoker tobacco workers had significantly lower percentage of predicted values of FVC, FEV_1 and FEV_1% than control subjects ($p < 0.001$). In addition, they had significantly lower values of FEV_1 and FEV_1% than non-smoker tobacco workers ($p < 0.01$). **Conclusion:** Pulmonary functions may be impaired in smoker tobacco workers.

Key words: FVC, FEV_1 and FEV_1%.

J Bangladesh Soc Physiol. 2011 December; 6(2): 90-93
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http://www.banglajol.info/index.php/JBSP

Introduction

Tobacco industries provide livelihood to tobacco workers who are engaged in tobacco cultivation, processing and rolling of bidis /cigarettes. Environment of tobacco industries are usually polluted by tobacco dust. Inspirable dust concentration is about 150-fold higher in tobacco factories [1]. Endotoxin concentration also increased in the air of tobacco factories [2]. Workers of tobacco industries are chronically and predominantly exposed to tobacco dust and majority workers of tobacco industries are smokers non-smoker tobacco workers are also exposed to passive smoking at their work places [3]. Inhalation is the common route of absorption of air borne contaminants caused by tobacco dust and smoke and deterioration of lung functions is related to inhalation of dust [4].Tobacco dust exposure induces oxidative stress among tobacco workers that leads to impairment of lung functions and lung diseases [5]. Tobacco smoke is a bioaerosol that contains endotoxin, peptidoglycan fragments, lypopolysaccharide, various fungal

Received September 2011; Accepted December 2011

and bacterial constituents [6]. Tobacco smoke also contains a large number of free radicals, including peroxyl radicals, superoxide anion and nitrogen oxide [7]. Active and passive or environmental smoking has an adverse effect on lung functions [8 - 15]. Tobacco dust contains agents that cause nonimmunolgically mediated broncho-constriction [16]. Several investigators reported decreased lung functions in workers who work in tobacco industries.[17-20]

There are many tobacco factories in many parts of Bangladesh and in Rangpur district a remarkable population engaged in tobacco industrial activities. But unfortunately they are not aware that they are at the risk of impaired lung functions. To the best of our knowledge, assessment of tobacco workers lung functions status has not been studied in our country. From the public health point of view it is urgent to protect their lung health. Considering this the present work was carried out to study the status of lung functions in tobacco industry workers by measuring Forced Vital Capacity, Forced Vital Capacity in first second and Percentage of Forced Vital Capacity in 1st Second (FVC, FEV_1 and FEV_1%). The outcome of this study would help to create awareness among the tobacco workers and authorities and they may take appropriate measures to protect lung health against tobacco hazards.

Methods

This cross-sectional study was carried out in the Department of Physiology, Rangpur Medical College, Rangpur, from July 2008 to June 2009. A total number of 140 apparently healthy male subjects of 20 to 45 years age were included in this study. Among them 50 were male smoker workers of tobacco industry (Group B) who smokes at least five Bidi per day for at least last two years (up to 15 years), 40 were male non-smoker tobacco industry workers (Group C) and 50 were non-smoker non-tobacco workers were control (group A). Tobacco workers are engaged eight hours per day in the tobacco factory for at least two years. All the study subjects were selected from different tobacco factories of Rangpur district and control subjects were selected from the surrounding community. Significantly disabled subjects who unable to perform s pirometric procedures and subjects with respiratory diseases like asthma, chronic obstructive pulmonary diseases, pulmonary tuberculsis or any form of acute illness were excluded from the study. Study protocol was approved by ethical committee of Rangpur Medical College, Rangpur. After selection of the subjects, objectives and benefits of this study were explained to each subject and an informed written consent was taken. A detail personal, medical, family, socioeconomic, smoking and working history were recorded in a preformed questionnaire and thorough physical examinations were done and were documented. Height and weight of the subject were measured for the calculation of the body surface area [21]. Then measured and percentage of predicted value of FVC, FEV_1 and FEV_1% were recorded by a digital spirometer. Data were expressed as mean ± SD. Statistical analysis was done by using SPSS version 12. and unpaired't' test were used for statistical analysis.

Results

FVC, FEV_1, were significantly(<0.001) lower in smoker and in non smoker tobacco worker than those of control but no significant difference in FVC was found between smoker and non smoker tobacco worker. Again, FEV_1 were significantly (<0.001) lower in smoker tobacco worker compared to non smoker tobacco worker. FEV_1%, was significantly lower in smoker than those of control and non smoker tobacco worker but the difference of this parameter between nonsmoker tobacco worker and control was not statistically significant.(Table I)

TableI: Mean ± SD of percentage of predicted value of FVC, FEV_1, FEV_1%in different groups (n = 140).

Group	FVC	FEV_1	FEV_1%
A(n=50)	94.58 ± 14.14	97.34 ± 15.98	111.88 ± 4.97
B(n=50)	67.55 ± 22.23	63.58 ± 19.84	102.98 ± 10.49
C(n=40)	73.95 ± 12.56	74.45 ± 12.88	109.80 ± 7.12
Statistical analysis			
Avs B	0.000 ***	0.000 ***	0.000***
Avs C	0.000 ***	0.000 ***	0.107ns
Bvs C	0.238 NS	0.008 **	0.001**

Group A : non-smoker non-tobacco workers.
Group B : smoker tobacco workers.
Group C : non-smoker tobacco workers.
n = Total number of subjects.*** = Significant at $p < 0.001$** = Significant at $p < 0.01$ NS= Not significant

Discussion

In the present study FVC, FEV_1 and FEV_1% were assessed in male smoker and non smoker tobacco industry workers and compared with those of age and body surface area matched controls.

In this study, values of FVC, FEV_1 and FEV_1% of control subjects were within normal limit. Smoker tobacco workers had significantly lower percentage of predicted values of FVC, FEV_1 and FEV_1% than control subjects. In addition, they had significantly lower of these values of FEV_1 and FEV_1% than non-smoker tobacco workers but no significant difference in FVC between smoker and nonsmoker tobacco workers was observed. Again nonsmoker tobacco workers also had significantly lower percentage of predicted values of FVC and FEV_1 than control subjects. Similar findings were also reported by some researchers of other countries [17 - 20].

Various mechanisms have been proposed by different investigators for the impairment of lung functions of smoker and non-smoker tobacco industry workers. It has been suggested that tobacco dust contains various immunologically active as well as toxic substances.Chronic inhalation of these substances produce increased airway reactivity and increased airway resistance and decreased elastic recoil of lung tissue. All these factors are responsible for decreased FVC, FEV_1 and FEV_1% [17 – 20].

In the present study it is difficult to comment on exact mechanisms of impaired ventilation on tobacco workers. Chronic exposure to tobacco dust causes its accumulation in the air ways and lung parenchyma of these tobacco workers. Dust activates alveolar macrophages which might induce some inflammatory changes causing fibrosis of lung parenchyma [21].

In addition, chronic allergic effects of tobacco dust decreased lung functions including vasodilatation increased vascular permeability producing inflammatory edema and tissue destruction may be linked to the reduced ventilation in tobacco workers.

Again, the adverse effects of nicotine in addition to tobacco dust on the lung function are evident in the smoker tobacco workers as they had lower volumes air flow than their non-smoker colleagues.

Conclusion

The result of this study concludes that impairment of pulmonary functions may occur in workers in tobacco industry which may even be more decreased in Bidi smokers.

Acknowledgement

Authors of this study are thankful to the authority of Rangpur Medical College and authorities of those Tobacco Factories of Haragach, Rangpur whose cooperation makes this study successful. The authors also acknowledge the partial financial support from the research grant of Directorate General of Health Service of Bangladesh.

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References

1. Bhisey RA, Bagwe AN, Mahimkar MB, Buch SC. Biological monitoring of bidi industry workers occupationally exposed to tobacco. Toxicol Lett. 1999; 108 (2-3): 259-265 [Medline].

2. Uitti J, Nordman H, Huuskonen MS, Roto P, Husman K, Reiman M. Respiratory health of cigar factory workers. Occu and Environ Med. 1998; 55: 834-839.

3. Chen R, Tunstall-Pedoe H, Tavendale R. Environmental tobacco smoke and lung function in employees who never smoked: the Scotish MONICA study. Occup. Environ. And Med. 2001; 58: 563 - 568.

4. Sunter AT, Bagirici F, Dundar C, Marangoz A, Peksen Y. Lung Function in Workers Exposed to Tobacco Dust. Turk J Med Sci. 2001; 31:143 -146.

5. Swami S, Suryakar AN, Katkam RV, Kumber KM. Absorption of nicotine induces oxidative stress among bidi workers. Ind J Pub Health. 2006; 50(4): 231-5. [Medline].

6. Larsson L, Szponer B, Ridha B, Sitkowska J. Identification of bacterial and fungal components in tobacco and tobacco smoke. Tobacco Induced Diseases. 2008; 4 (1): 1 - 10.

7. Pryor WA and Stone K. Oxidants in cigarette smokes, Radicals, hydrogen peroxide, peroxinitrate and peroxinitrite. Ann N Y Acad Sci. 1993; 686: 12-27.

8. Gold DR, Wang X, Wypij D, Speizer FE, Ware JH, Dockery DW. Effects of Cigarette Smoking on Lung Function in Adolescent Boys and Girls. The New Eng J Med. 1996; 335 (13): 931 -937.

9. Blackburn H, Brozek J, Talor HL. Lung volume in smokers and non-smokers. Ann Intern Med 1959; 51: 64-77.

10. Edelman NH, Mittman C, Morris AN, Cohen HB, Shoch WB. The effect of cigarette smoking upon spirometric performance of commonly dwelling man. Am Rev Res Dis 1960; 94: 421-429.

11. Downs SH, Brandili O, Zellweger J-P, Schindler C, Kunzli N, Gerbase MW et.al. Accelerated decline in lung function in smoking women with airway obstruction, Resp Res. 2005; 6: 45.

12. Fidan F, Cimrin AH, Ergor G, Sevinc C. Airway diseases risk from environmental smoke among coffee house workers in Turkey, Tobacco Control. 2004;13:161 -166.

13. Eisner MD, Yelin EH, Henke J, Shiboski SC, Blanc PD. Environmental Tobacco Smoke and Asthma, Am J Crit Care Med. 1998; 158: 170 – 175.

14. Yu-Fen LI, Gilliland FD, Berhane K, McConnell R, Gauderman WJ, Rappaport EB et.al. Effects of In Utero and Environmental Tobacco Smoke Exposure on Lung Function in Boys and Girls with and without Asthma, Am J Crit Care Med. 2000; 162: 2097 – 2104.

15. Anderson DD and Ferris BJG. Role of tobacco in causation of chronic respiratory disease. New Eng J Med 1962; 267:786-294.

16. Schachter EN, Zuskin E, Goswami S, Castronova V, Siegel P, Whitmer M et.al. Pharmacological Effects of Tobacco Dust Extract on Isolated Guinea Pig Trachea. CHEST 2003; 123: 862-868.

17. Chattopadhyay BP, Kundu S, Mahata A, Jane ASK. A study to asses the respiratory impairments among the male beedi workers. IJOEM 2006; 10(2): 69 -73.

18. Kjaergaard SK, Pedersen OF, Frydenberg M, Schonheyder H, Anderson P, Bonde GJ. Respiratory diseases and lung function in a tobacco industry. Aech Environ Health 1989; 44; 164 – 170.

19. Yanev I. Dynamic study of respiratory functions in tobacco workers. Folia Med. (Plovdiv) 1987; 29: 33 - 41.

20. Mukhtar M-SR, Rao GMM, Gamra NS, Afan AM, Zendah MI. Respiratory effects of occupational exposure to tobacco dust. Respiration 1991; 58: 271-276.

21. Rahman MH and Mostakim MA. Pediatric Emergency Medicine, 1st edn. Rangpur; published by Dr. Mrs. Moatakim, Banglasesh: 2002; 173.

22. Kabzic L. The Lung. In: Robbin's Pathologic Basis of Diseases. edited by Cotran RS, Kumar V and Collins T. 6th edn. Philadelphia: WB Saunders Company, 1999; 697-755.