ORIGINAL ARTICLE

A Study on adverse effect of smoke/flue on lung functions of glass factory workers of Firozabad district

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Abstract

The pulmonary function impairment is the most common respiratory problem in industrial plants and their vicinity. Therefore, the purpose was to study the effects of furnace smoke and flue and its duration of exposure on lung function. This was a matched cross-sectional study of Spirometry in 100 bangle workers with age range 20 – 60 years, who worked without the benefit of smoke control ventilation or respiratory protective devices. Pulmonary function test was performed by using Digital Spirometer (Spiro-excel). Significant reduction was observed in the mean values of Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), Forced Expiratory Ratio (FEV1/FVC), Forced Expiratory Flow (25%-75%) and Peak Expiratory Flow Rate (PEFR) in bangle workers relative to their matched controls. This impairment was increased with the duration of exposure to fumes in bangle industries. It is concluded that lung function in bangle workers is impaired and stratification of results shows a dose-response effect of years of smoke and flue exposure on lung function.

Key Words

Occupational Hazards; Pulmonary Function; Bangle Workers

Introduction

Airborne occupational exposures to irritants, vesicants and fibrogens have the potential to cause pulmonary function impairment when exposures are not properly controlled over extended periods of time. Pulmonary function tests in various industrial workers have been studied but very little information is available on workers involved in bangle or glass industry. Present study emphasizes on changes in lung function of bangle industry workers in Firozabad district who are continuously exposed to fumes emitting from the furnaces. They are also exposed to poisonous gases, heat stress and various multi-metals that are used as bangle dyes. Thus the overall lung function is decreased significantly (Rastogiet al 1982).

Occupational pulmonary diseases are more disabling than any other group of occupational disease. The lung with its extensive surface area and high blood flow is an important site of contact with substance in environment. The inhalation of fumes over periods of time leads to restrictive and obstructive changes in lungs. The overall effect on workers in glass bangle industry is decrease in lung functions which may be manifested in the form of obstructive or restrictive lung disease or both the conditions may simultaneously coexist in the same subject ((Rastogiet al. 1982 and EugenijaZuskinet al. 1984).

Aims & Objectives

To study the adverse effects of smoke on lung functions of glass factory workers.

Material and Methods

The study was carried out in bangle industries in Firozabad district, Uttar Pradesh. The present study was conducted in 100 male subjects and 100 controls of age group 20-60 years. Spirometry was performed

on Digital Spirometer (Spiro-excel). All pulmonary function tests were carried out at a fixed time of the day (9:00 – 13:00 h) to minimize the diurnal variation (Glindmeyeret al. 1994). After taking a detailed history and anthropometric data, the subjects were informed about the whole manoeuver. They were encouraged to practice this manoeuver before doing the pulmonary function test. The test was performed with the subject in the sitting position using a nose clip. The test was repeated three times after adequate rest, and results were obtained, available in the Spirometer.

The parameters included in test were Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), Forced Expiratory Ratio (FEV1/ FVC), Forced Expiratory Flow (FEF25% – 75%) and Peak Expiratory Flow Rate (PEFR).

Results

Table 1 and Table 5 shows distribution of subjects and controls according to age. Majority of the subjects were in the age group 31-40 yrs. There was no significance difference between the two groups.Table 2 shows anthropometric data of subject and control groups. There was no significance difference between the two groups. Table 3 and Table 4 shows vital data of subject and control groups. There was no significance difference between the two groups. Table 6 shows Pulmonary Function Tests of subjects and controls. There was significance difference between the two groups.

Discussion

In the present study, numerous factors were considered which greatly influence the lung functions including age, height, weight, body mass index and socio-economic status. However, in previous studies many authors failed to consider these variables. The results in this study are indicating that workers of different bangle industries are prone to respiratory dysfunctions while working in them. The workers at coal/gas furnaces showed significantly low values of FEV1, FVC, FEV1/FVC % and highly significant decrease in PEFR which are in harmony with the findings as reported by (Rastogiet al.1982 and EugenijaZuskinet al. 1984).

The present study demonstrates a strong association with a dose-effect between smoke/flue exposure and decreased pulmonary function. Impairment in bangle industry workers is directly proportional to the duration of exposure. Bangle/glass industry workers with exposures longer than 10 years showed a significant reduction in FEV1, FVC, FEV1/FVC and PEFR (Table 2).Our results are in conformity with the former results observed by Attfield, M. D. (1985) Baker, D. B. and Landngan, P. J. (1990).

Conclusion

Following conclusions were drawn from study: Dynamic lung volumes and capacities FEV1 and FVC were significantly reduced in study groups (glass bangle industry workers) as compared to control groups. The ratio FEV1/FVC% was also reduced significantly in subject groups. The flow rate PEFR decreased much significantly in bangle industry workers as compared to controls. There was no significant change in FEF 25%-75% in subjects compared to controls. Decrease in FEV1, FVC, FEV1/FVC and PEFR were dose dependent i.e. higher the duration of exposure resulted in more decline of lung function parameters.

Recommendation

It is advisable therefore, that health risk should be reduced by the mutual collaboration between health officials, glass industry workers and their management to adopt technical preventive measures, such as ventilated work areas and wearing appropriate respiratory protective equipment's.

Authors Contribution

1,3: Design the Study, 2,5: Collected the data, 4,6: Analyze the study.

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Tables

TABLE NO. 1 DISTRIBUTION OF SUBJECTS AND CONTROLS ACCORDING TO AGE GROUP

Age Group (Years)	No. of Subjects (Total =100)	No. of Controls (Total =100)
21-30	28	26
31-40	46	48
41-50	14	15
51-60	12	11

TABLE NO. 2 ANTHROPOMETRIC DATA OF SUBJECT AND CONTROL GROUPS

Variables	SUBJECTS (n=100) Mean ± SD	CONTROLS (n=100) Mean ± SD	p-Value	t- Value
Age(years)	32.31 ± 3.12	32.26 ± 4.17	> 0.05	0.096
Height (cm)	170.68 ± 5.46	171.36 ± 4.76	> 0.05	0.938
Weight (kg)	64.23 ± 3.46	64.54 ± 4.37	> 0.05	0.556
BMI (kg/m²)	22.048 ± 2.16	21.979 ± 2.34	> 0.05	0.216

p- Value > 0.05 is considered as non- significant

TABLE NO. 3 VITAL DATA OF SUBJECT AND CONTROL GROUPS

Variables	SUBJECTS (n=100) Mean ± SD	CONTROLS (n=100) Mean ± SD	p-Value
Pulse Rate(beats/min)	76.80 ± 4.12	76.46 ± 4.24	> 0.05
Systolic BP (mm Hg)	128.24 ± 8.48	128.32 ± 8.34	> 0.05
Diastolic BP (mm Hg)	84.24 ± 4.38	84.18 ± 4.26	> 0.05

p- Value > 0.05 is considered as non- significant

TABLE NO. 4 VITAL DATA OF SUBJECT AND CONTROL GROUPS

Exposure (Years)	No. of Subjects (Total =100)
<05	38
6-10	22
11-15	18
16-20	12
>20	10

TABLE NO. 5 DISTRIBUTION OF SUBJECTS AND CONTROLS ACCORDING TO AGE GROUP

Parameters	Exposure(<10 Yrs)	Exposure(>10 Yrs)
FEV1(litres)	2.42 ± 0.12	2.32 ± 0.14
FVC(litres)	2.96 ± 0.12	2.84 ± 0.09
FEV1/FVC%	81.76 ± 2.18	81.69 ± 2.14
PEFR(litre/sec)	5.90 ± 0.82	4.54 ± 0.58
FEF25%-75%	3.51 ± 0.32	2.28 ± 0.14

TABLE NO. 6 PULMONARY FUNCTION DATA OF SUBJECT AND CONTROL GROUPS

Parameters	SUBJECTS (n=100) Mean ± SD	CONTROLS (n=100) Mean ± SD	p- Value	t- Value
FEV1 (litres)	2.52 ± 0.12	2.86 ± 0.09	p < 0.05	3.744
FVC (litres)	2.98 ± 0.12	3.12 ± 0.10	p < 0.05	8.962
FEV1/FVC%	84.56 ± 2.32	91.60 ± 1.61	p < 0.05	24.929
FEF25% –75%	3.32 ± 0.17	3.36 ± 0.20	p > 0.05	1.52
PEFR(litre/sec)	5.960 ± 0.85	6.245 ± 0.74	p < 0.05	2.52

p- Value < 0.05 is considered as significant

p- Value > 0.05 is considered as non-significant