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Research Article

Peak expiratory flow rate among workers engaged in stone crushing units surrounding, Gulbarga city

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ABSTRACT

Background: A periodic measurement of lung functions would be a guiding principle to detect the lung abnormalities in the early stages and among lung function tests, peak expiratory flow rate (PEFR) is useful. The industrial workers are subjected to illness suffered not only of those of fellow citizens but are also subjected to certain illness due to mainly their work environment which is peculiar to each work place or industry. The objective of the study was aimed at the PEFR of workers in stone crushing units, Gulbarga city. The authors were also aimed at the study of the factors influencing PEFR of the workers and to suggest the various measures for the improvement in the health status of the workers.
Methods: The study was undertaken among the workers engaged in stone crushing units and related respiratory ailment among workers based on PEFR in stone crushing units surrounding Gulbarga city, Karnataka, India. The study sample comprised a total of 150 workers examined.
Results: The result of the study showed that 51 (34%) workers with less than 400 L/min PEFR having signs and symptoms like breathlessness and cough were as 99 (66%) workers with PEFR 400-600 L/min were normal. The study also shows that there is highly significant association between lung function parameter (PEFR) with duration of exposure.
Conclusions: The result indicated the need to increase awareness among the workers regarding the dust generated by crushing units.

Keywords: Stone crushing unit, Peak expiratory flow rate

INTRODUCTION

Urbanization and industrialization has been a universal phenomenon. However industrialization can occur at places where the raw material, work force or ready market for finished product is available. In India the total work force comprises around 240 lakhs, out of which 92.5% is in un-organized sectors, though a small segment is well organized and this group is harvesting the rich benefits due to them either lawfully or unlawfully. The industrial workers are subjected to illness suffered not only of those of fellow citizens but are also subjected to certain illness due to mainly their work environment which is peculiar to each work place or industry. The workers in the stone grinding units inhales large amount of dust generated by crushing units. This dust contains silicon di oxide or free silica which is responsible for oldest and most dreaded of all occupational disease silicosis. Silicosis outnumbers the other types of pneumoconiosis. Being a respiratory ailment, this group of disorders impairs the pulmonary functions. However, this detoriaton in the pulmonary function is noticed in advanced stages of the disease when much of the lung is damaged. As disease causation is of multifactorial dimension, the prevention and control includes not only the traditional methods but also includes the newer

measures where a lot of ingenuity has gone into prevention and control measures. Thus, a periodic measurement of lung functions would be a guiding principle to detect the lung abnormalities in the early stages. Among these lung function tests peak expiratory flow rate (PEFR) is a useful pulmonary function test. PEFR may be simply measured using equipment such as Wright peak expiratory flow meter; the machines were cheap and portable and serve a variety of functions. However, it is difficult to make definite conclusions about the alterations in peak expiratory flow rate in workers with silicosis, since considerable variability in individuals cases may be present probably because of multifactorial effects of concurrent cigarette smoking, the type of dusts involved in the exposure (mixed versus pure), the dose of dust and the duration of exposure and the other pulmonary diseases such as tuberculosis.[2] Hence, a study was undertaken to determine the respiratory ailment which impairs the pulmonary functions of the lung due to the inhalation of silica dust over a period of time among the workers working in stone crushing units surrounding Gulbarga, Karnataka.

Aim and objectives of study were aimed at followings:

1. To study the peak expiratory rate of workers in stone crushing units, Gulbarga, Karnataka.
2. To study the factors influencing Peak Expiratory Rate of the workers.
3. To suggest the various measures for the improvement in the health status of the workers.

METHODS

Study settings

The present study was carried out surrounding Gulbarga city which is in the northern part of Karnataka, India.

Study period

The study was conducted for a period of 1 year.

Inclusion criteria

All the workers who were engaged in the stone crushing units including watchman and drivers.

Exclusion criteria

Other than workers like owner of the unit.

Data analysis

Statistical data analysed by using SPSS Windows 16.0 version, large sample test (Z-test) is applied for significance.

Ethics approval and consent

Research was initiated after acceptance of the study by the ethical committee of the M.R. Medical College Gulbarga, India. Informed written consent was taken from participants.

Methodology

The cross sectional study was conducted in 16 stone crushing units surrounding Gulbarga city Karnataka, India. And comprising 150 workers engaged in these units.

All the subjects were personally contacted examined and interviewed using pre-designed and pre-tested proforma. This was followed by a detailed clinical examination, anthropometric measurements and investigations like peak expiratory flow (Wright peak flow meter) and X-ray chest.

RESULTS

Table 1: Distribution of workers according to age.

Age in group (in years)	No. of workers	
	No.	%
15-25	20	13.33
25-35	41	27.33
35-45	54	36.00
45-55	35	23.33
Total	150	100.00

In the present study, 63.33% workers were between 25-45 years. None of the workers were below 15 years or above 55 years as stone crushing is a heavy manual work.

Table 2: Distribution of workers based on education status.

Education status	No	%
Illiterates	98	65.33
Primary	39	26.00
Higher primary	13	8.67
Total	150	100.00

In the study, 65.33% were illiterate, as a whole literacy is low in Gulbarga district with a total literacy percentage of only 50.65%.

Table 3: Distribution of workers based on habits.

Habit	No	%
Smoking	31	20.67
Alcohol	33	22.00
Gutka	57	38.00
No Habit	29	19.33
Total	150	100.00

80.67% workers had one or other habits of either smoking, gutka chewing or alcohol consumption. The stone crushing is a monotonous job and requiring higher muscular activities these workers tend to have one or other habit.

The study revealed that there was highly significant association between lung function parameter and age as seen in the form of inverse proportion as age was advancing there was lowering in lung function. It was observed from table 5 that there was highly significant association between lung function parameters and duration of exposure. More was the duration of exposure in months, lower is the PEFR ($P < 0.001$).

DISCUSSION

The present cross sectional study was conducted among workers in stone crushing units surrounding Gulbarga city. The study was carried among the workers working in 16 stone crushing units numbering 150 with the objective of studying the health status and various factors influencing the health. None of the workers were below 15 years or above 55 years as stone crushing is a heavy manual work. Similar findings were observed by Tiwari et al in his study among quartz stone grinders of Chotedepur i.e. 48.6% workers were between 30-45 years age group.[1]

Table 4: Association between lung function parameter (PEFR) with age group.

Age	PEFR (<400)	%	PEFR (400-600)	%	Total	%
15-25	0	0.00	20	20.20	20	13.33
25-35	7	13.73	34	34.34	41	27.33
35-45	17	33.33	37	37.37	54	36.00
45-55	27	52.94	8	8.08	35	23.33
Total	51	100.00	99	100.00	150	100.00
Mean±SD	44 ± 8.23		33.30 ± 8.01			

Z=7.61, P < 0.001, highly significant

Table 5: Lung function parameter according to duration of exposure.

Duration of exposure (in months)	PEFR (<400L /min)	%	PEFR (400-600L/min)	%	Total	%
<20	8	15.69	28	28.28	36	24.00
20-40	19	37.25	48	48.48	67	44.67
40-60	8	15.69	15	15.15	23	15.33
60-80	10	19.61	8	8.08	18	12.00
80-100	5	9.80	0	0.00	5	3.33
≥100	1	1.96	0	0.00	1	0.67
Total	51	100.00	99	100.00	150	100.00
Mean±SD	44.55±25.76		29.80±16.59			

Z=3.71, P < 0.001, highly significant

In the present study, 65.33% were illiterate as a whole literacy is low in Gulbarga district with a total literacy percentage of only 50.65%.[2] However Tribuwan et al found out similar findings among stone quarry workers of 68% illiterates in his study.[3]

Similar findings were observed by Tiwari et al in his study among quartz stone grinders of Chotedepur i.e. 80.67% workers had one or other habits of either smoking, gutka chewing or alcohol consumption out of these habits it was found that 39% of workers were smokers as stone crushing is a monotonous job and requiring higher muscular activities.[4]

It was observed that there was lowering in lung function with advancing age. However Ghotkar et al, in their study found a decrease in pulmonary function with increase in years of exposure, which was not found statistically significant.[5] Similar observation was made by Rajendra Prasad et al in his study observed that there was inverse proportion between advancing age and lowering of lung function and had highly significant association between lung function parameters and duration of exposure.[6]

It was observed that more was the duration of exposure in months, lower was the PEFR (P <0.001). Similar observation was made by Tiwari et al that lung function parameters were reduced with increasing duration of exposure PEFR was 6.49±2.68 in subjects exposed 1-2 years 5.13±1.92 in subjects who were exposed to 3-4 years and 4.71±2.16 in subjects who were exposed for ≥4 years.[7]

CONCLUSION

The present study reveals that all the workers were in the age group between 25 to 55 years, belonging to class IV Kuppuswamy socio-economic status, majority 63.33 were the illiterates and 80% had one or the other habits like smoking chewing gutka or alcohol consumption. Mean duration of exposure among workers was 34.69±21.41 months and there was highly significant association observed between duration of exposure and PEFR (p<0.001). To conclude workers at stone crushing units have reduced lung function capacity within 5 years of exposure due to silica. These workers should use protective gears in order to prevent inhalation of silica dust. The industry also requires dust elimination measures at the site of production in order to maintain environment.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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