Journal of Academia and Industrial Research (JAIR)
Volume 8, Issue 3, August 2019



ISSN: 2278-5213

Research Article

# A study of Pulmonary Function Test in Stone Quarry Industry Workers in Wardha District

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*Received: June 09 2019/Accepted: 30 July 2019/Published: 07 August 2019*

## Abstract

There is a widespread misconception that occupational health is mainly concerned with industries and industrialized countries. But in a country like India, millions of people are engaged in labor like stone grinding, Quarry workers, weaving, etc. So this study assessed the pulmonary function test among the Stone Quarry industry workers in Wardha District. It was a community based Cross-sectional study carried out in the stone quarries situated in villages of Wardha district. Normal Pulmonary Function Test (PFT) 56.60%, Obstructive lung disease found in 10.34%, Restrictive lung disease in 31.04%, mixed lung disease in 2.02%, Abnormal PFT in all was (43.40%). Pulmonary function test parameters were found to be significantly reduced among the quarry workers.

**Keywords:** Stone quarry, pulmonary function test, spirometry, morbidity, obstructive lung disease.

## Introduction

There is a widespread misconception that occupational health is mainly concerned with Industries and industrialized countries. But in a country like India, millions of people are engaged in labor like stone grinding, quarry workers, weaving, etc. (Sabde, and Zodpey, 2008). Dust inhalation has been co-related with number of respiratory diseases as one of the etiological factor in form of pneumoconiosis, silicosis, byssinosis, grain fever syndrome, occupational asthma, farmer's lung etc. With a progressive trend towards industrialization, there is a definite increase in occupational lung diseases (Vyas, 2012). The Indian National Institute of Occupational Health (NIOH) (1987) reported 22% prevalence of silicosis in stone quarry workers in 1987, and since 2002 have completed studies showing that the levels of silica in stone crushing workplaces were so high that only six months of work was sufficient to cause silicosis (Maxted, 2012). Occupational health problems are not only problems for the worker, but above all they are problems of work and the work environment. The work environment varies greatly according to type of economic activity, occupation, company and size of workplace. Geographic and climatic conditions also have a great impact on the work environment, particularly in outdoor activities. The occupations, which expose workers to silica dust, include sandstone quarry, agate industry, slate-pencil cutting industry, ceramic and pottery industry and many more (WHO, 2012).

Hence this study was done to observe the pulmonary function test in stone quarry workers who are exposed directly to the dust coming out of the stone quarries. Therefore keeping the above fact in view, this study was aimed to study the pulmonary function test in stone quarry industry workers in Wardha District.

## Materials and methods

***Study population and research design*:** It was a community based Cross-sectional study. This cross sectional study was carried out at stone quarries situated in Yelakeli, Deoli, Paloti, Pulgaon, Borgaon, Nachangaon in Wardha district. The subjects for this study were workers from these stone quarries who had been working for more than 1 year. A detailed health status appraisal was done for all the workers included in the study. It included personal details through history, clinical examination and Pulmonary Function Test was performed on all the participants.

***Sampling technique and size:*** Simple random sampling was chosen for the study purpose. Literature review indicated that respiratory morbidity amongst the quarry workers was found to be 32% (Mathur and Dixit, 1999). Based on the above observation with an (alpha) α level of 0.05 and (beta) β of 0.05 (power=95%). The total sample size was calculated as 334. During the course of the study total of 348 workers participated in the study and this formed the sample size.

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Table 1. Assessment of respiratory morbidities using Pulmonary Function Test (PFT).

| Respiratory morbidities | Total Quarry Worker | | Total (n=348) (%) |
|---|---|---|---|
| | Male, n=292(%) | Female, n=56(%) | |
| Normal | 170(48.85%) | 27(7.7%) | 197 (56.60%) |
| Obstructive lung disease | 31(8.90%) | 5(1.45%) | 36 (10.34%) |
| Restrictive lung disease | 84(24.13%) | 24(6.89%) | 108 (31.03%) |
| Mixed lung disease | 7(2.01%) | 0(0.00%) | 7 (2.01%) |

Table 2. Various factors associated with morbidity in quarry workers.

| Variables | Morbidity (%) n=197 | No Morbidity (%) n= 151 | Chi-Square Test |
|---|---|---|---|
| Addiction (multiple responses) | | | |
| Tobacco | 129(37.00%) | 112(32.10%) | $\chi 2$= 2.041<br>df=2<br>p = 0.360, NS |
| Smoking | 16(4.50%) | 14(4.02%) | |
| Alcohol | 94(27.00%) | 61(17.50%) | |
| Pulmonary Function Test (PFT) | | | |
| Normal | 111(31.90%) | 86(24.70%) | $\chi 2$= 0.616<br>df = 3<br>p>0.05, NS |
| Obstruction | 21(6.03%) | 15(4.30%) | |
| Restriction | 62(17.80%) | 46(13.20%) | |
| Mixed | 3(0.80%) | 4(1.10%) | |

NS = Non-significant.

***Data collection:*** The necessary approval was obtained from Ethics Committee, JNMC Sawangi, DMIMS (DU), Wardha to conduct the study. A pretested questionnaire was prepared comprising of Socio-demographic profile, Detail Clinical History and Physical examination, Pulmonary Function Test (PFT). After fulfillment of the inclusion criteria, workers were interviewed and a rapport was developed ensuring confidentiality regarding the use of data for research purpose only. The tool used was pretested questionnaire. The survey was done by face to face interview and pulmonary function test of the workers was carried out by spirometry.

***Statistical analysis:*** The data was entered into Microsoft Excel spreadsheet. Subsequently it was analyzed using SPSS (Statistical Package for Social Sciences) Version 16.0 Data was tabulated according to frequency distribution tables. Quantitative variables such as age, duration of working, Spirometric reading etc. were summarized through mean, median etc.

## Results and discussion

Normal PFT 56.60%, Obstructive lung disease found in 10.34%, Restrictive lung disease in 31.04%, mixed lung disease in 2.02%, Abnormal PFT in all was (43.40%). Rao *et al.* in 2006 in their study among female quartz grinders found that out of 106 workers, 75 (70.8%) had normal spirometry, 18 (17.0%) restrictive type, 9 (8.5%) obstructive type, and 5 (3.8%) combined type spirometry abnormality. Tobacco chewers (37.00%) and Alcohol (27.00%) addicted workers were found more prone to general health illnesses.

Those with restrictive lung disease (17.80%) were found to have general illnesses more than obstructive lung diseases (6.03%). The mean observed value is 5.567 ± 1.786 L/min. When the absolute values of PEF were analyzed against variables PEF was statistically significant and lower in those aged ≥ 35 years when compared with <35 years**,** Similar finding was observed in duration of work <5 years and ≥5 years. Other variables like the gender, smoking and respiratory morbidity were not found to be significant. Sivacoumar *et al.* (2006), found there was a significant association between pulmonary function and increasing dust concentration and years of working, exposure to dust adding strength to the evidence that contributions from the work environment to the observed respiratory impairments may be substantial. Ghotkar *et al.* (1995) observed the impairment of lung function was significantly associated with increasing age, duration of dust exposure, smoking status and presence of chronic obstructive airways disease. There was statistically significant decrease in PEFR of male workers and FEV, and FVC of female workers after the age of 40 years. There was no significant difference in mean pulmonary function values in workers engaged in different aspects of quarrying as there was no significant difference in dust concentration at different work places.

## Conclusion

There is a need to evaluate the health status of quarry workers at regular intervals to provide appropriate preventive measures. Pulmonary function test parameters were found to be significantly reduced among the quarry workers.

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Table 3. Association of various risk factors with mean PEFR.

| Factors | Number of (%) Workers (n=348) | Mean Observed PEFR(L/s) (5.567±1.786) | SD | t Test |
|---|---|---|---|---|
| Age | | | | |
| <35 years<br>≥ 35 years | 214(61.49%)<br>134(38.5%) | 5.79<br>5.35 | ±1.68<br>±1.89 | t =2.265<br>P=0.024<br>S* |
| Gender | | | | |
| Males<br><br>Females | 292(83.9%)<br><br>56(16.09%) | 5.66<br><br>5.41 | ±1.73<br><br>±1.99 | t= 0.966<br>p= 0.335<br>NS# |
| Smoking | | | | |
| Smokers<br><br>Non smokers | 30(8.6%)<br><br>318(91.37%) | 5.20<br><br>5.66 | ±1.78<br><br>±1.77 | t= -1.36<br>p= 0.175<br>NS# |
| Duration of exposure | | | | |
| <5 years<br><br>≥5 years | 124(35.63%)<br><br>224(64.36%) | 5.97<br><br>5.43 | ±1.72<br><br>±1.78 | t= 2.743<br>p=0.006<br>S* |
| Respiratory Morbidity | | | | |
| Present<br><br>Absent | 114(32.75%)<br><br>234(67.24%) | 5.54<br><br>5.66 | ±1.71<br><br>±1.81 | t= -0.591<br>p= 0.555<br>NS# |

S*= Significant, #NS= Non-Significant.

Based on the pulmonary function test, present study findings have revealed a higher prevalence of respiratory morbidity among quarry workers. Keeping in view the above conclusive points it can be recommended that:

1. Regular measurement of lung function test among the quarry workers would be a useful tool to detect the lung abnormalities in the early stages.
2. Personal protective equipment and Preventive measures should be implemented against dust inhalation.
3. Information, Education and Communication (IEC) should be used to create awareness among the quarry workers.
4. Pre-placement and periodic examinations should be done in order to screen out illnesses among the stone quarry workers.
5. Forming peer groups so as to give support and encouragement to quit smoking, chewing tobacco and alcohol.

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*Cite this Article as:*

Prasad, M. and Wagh, V. 2019. A study of Pulmonary Function Test in Stone Quarry Industry Workers in Wardha District. *J. Acad. Indus. Res.* 8(3): 52-54.

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