

## Effect of Length of Exposure to Silica Dust on Peak Expiratory Flow Rate among Stone Crushers of Quetta, Pakistan

Tanzeel Ahmed<sup>1</sup>, Noman ul Haq<sup>1</sup>, Muhammad Ammar<sup>2</sup>, Muhammad Waqas<sup>3</sup>, Muhammad Minhas<sup>4</sup>

<sup>1</sup> Department of Pharmacy Practice, Faculty of Pharmacy and Health Sciences, University of Balochistan, Quetta, Pakistan

<sup>2</sup> Surgical III, Jinnah Hospital, Lahore, Pakistan

<sup>3</sup> Department of Pharmacology and Therapeutics, Bolan Medical College Quetta, Pakistan

<sup>4</sup> Centre of Excellence in Mineralogy, University of Balochistan, Quetta, Pakistan

### Research Article

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#### \*For Correspondence

Tanzeel Ahmed, Faculty of Pharmacy and Health Sciences, Department of Pharmacy Practice, University of Balochistan, Quetta, Pakistan, Tel: +923148126949.

**E-mail:** tanzeel\_ahmed27@yahoo.com

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#### ABSTRACT

**Objective:** To assess the impact of silicon dust on peak expiratory flow rate of stone crushers.

**Materials and methods:** The total 125 male study accused age of 18 years and > considered, out of which 75 from stone crushers and 75 were from general population selected from Quetta district, Pakistan. Respondents divided into two groups; group-I (stone crushers) and group-II (control group). Data was together by Spirometer. Peak expiratory flow rate (PEFR) calculated for both groups and explored. The frequency, percentage and descriptive statistical measurements observed for both groups by using SPSS 22. Related sample Wilcoxon signed rank test applied and sig level ( $P < 0.05$ ) observed.

**Results:** The total stone crushers were 75 out of which 19 (25.3) were smokers and 20 (26.7) were non-smokers. The mean value for peak expiratory flow rate between work exposure group >5 years (77.42), 5-15 years (79.87) and 15 years and > was (80.50) in stone crushers.

**Conclusion:** This study concluded that important difference found in the peak expiratory flow rate between stone crushers and control group, stone crushers showed the mild restrictive lung deficiencies but the control group was normal.

### INTRODUCTION

Pneumoconiosis constitutes the significant extent of the word related illnesses and is one of the old word related sicknesses. Since Ramazzini first portrayed this gathering of respiratory issue among the coal workers, various examinations has been done among specialists of different occupations presented to the different sorts of clean by temperance of their occupation. In any case, the silica clean, which is omnipresent in the environment, still out numbers alternate sorts of dust, in this manner making silicosis the most as often as possible happening pneumoconiosis. The occupations, which open specialists to silica dust, agate industry, slate pencil cutting industry, clay and ceramics industry, incorporate sandstone quarry, and some more <sup>[1]</sup>.

Stone crushing is imperative modern division in Pakistan <sup>[2]</sup>. It has little scale stone crushers in sloppy part in various rocky regions. These crushers give essential material to street and building development. They are occupied with exceedingly work concentrated exercises. It gives not just crude material to development of streets, structures, spans, and so forth yet in addition gives business to the nearby individuals <sup>[3]</sup>. Diverse phases of stone smashing procedure include boring and impacting of rocks, transportation of the crude material, pulverizing, screening, estimate arrangement, material taking care of, capacity operations and transportation of conclusive item. Mining operations cause huge emanations of Suspended Particulate Matter (SPM) in the

environment [4,5].

Business related contact to respirable precious stone like silica roots silicosis is associated with tuberculosis and lung tumor might be related to the development of immune system infections, for example, rheumatoid joint pain and constant renal malady. The silicosis, most extreme anticipating of the silica connected morbidities is an interstitial, lung contamination created primarily by means of the bite of demeanor of free precious stone like silica [6].

Peak expiratory flow rate is a valuable pneumonic capacity test. PEFR might be basically measured utilizing gear, for example, the Wright top expiratory stream meter. The machines are shabby and versatile and serve an assortment of capacities [1,7-9]. Be that as it may, is hard to influence clear decisions about the adjustments in crest expiratory stream to rate in laborers with silicosis, since significant inconstancy in people cases might be available, most likely on account of multifactorial impacts of simultaneous cigarette smoking, the sort of tidies engaged with the introduction (blended versus unadulterated), the dosage of clean and term of presentation and the other pneumonic infections, for example, tuberculosis [1].

There are many stone crushers units in Quetta, on account of bumpy locale of Balochistan. The primary point of this examination was to discover the impact of length of experience on PEFR esteem between stone crushers.

## MATERIALS AND METHODS

### Study Design

Case-control study.

### Study Setting

The study was conducted in Quetta, Pakistan.

### Study Population

The stone crushers and healthy population who had over one year of work encounter chose from Quetta, Pakistan.

### Sample Size

One hundred and twenty five stone crushers and healthy population were considered.

### Study Procedure

The pre consent taken from the every study respondents of both groups (group-I, consists of stone crushers and group-II, consists of healthy population) and informed about the aim of the study. The interview conducted on stone crushing crushers and healthy population of the Quetta district of Balochistan, Pakistan and recorded the data in the questionnaire and spirometry tests performed for stone crushers and healthy population separately, PEFR (peak expiratory flow rate calculated for both groups and analyzed.

### Statistical Analysis

The frequency, percentage and descriptive statistical measurements observed for both groups by using SPSS 20. Related sample wilcoxon signed rank test applied and significance level ( $P < 0.05$ ) observed.

### Ethical Requirements

Earlier consent filled from all the investigation respondents of the both groups' stone crushers and healthy population of Quetta, Pakistan.

## RESULTS

Group-I; total seventy-five men stone crushers selected out of which the mean  $\pm$  SD of age was  $28.04 \pm 8.921$ , smokers were 19 (25.3) and non-smokers were 56 (74.7). The mean  $\pm$  SD of pulse rate was  $84.88 \pm 17.830$ , systolic blood pressure was  $135.33 \pm 9.42$ , diastolic blood pressure was  $133.40 \pm 9.42$  and BMI was  $24.70 \pm 4.420$ . The incidence anemic disease in stone crushers were 2 (2.7), respiratory disease 21 (28.0), cardio vascular disease 5 (6.7) and dry cough 2 (2.7) as shown in **Table 1**. Group-II; total seventy-five men healthy population (control group) selected out of which the mean  $\pm$  SD of age was  $30.79 \pm 7.977$ , smokers were 20 (26.7) and non-smokers were 55 (73.3). The mean  $\pm$  SD of pulse rate was  $83.12 \pm 16.404$ , systolic blood pressure was  $122.48 \pm 11.142$ , diastolic blood pressure was  $82.81 \pm 13.321$  and BMI was  $24.98 \pm 3.980$ . The number and percentage of occurrence of anemic disease in stone crushers was 5 (6.7), cardio vascular disease 1 (1.3) and disease related to the central nervous system 1 (1.3) as shown in **Table 1**.

Spirometry comparison between stone crushing workers and control group (general population) shows that the mean value of stone crusher for PEFR in the work exposure group,  $<5$  years was (77.42), 5-15 years (79.87) and 15 years and  $>$  (80.50) but

the mean value of healthy population for PEFR in the work exposure group, <5 years was (91.80), 5-15 years (78.03) and 15 years and > (99.29) (Table 2).

**Table 1.** Demographics characteristics / frequency of different diseases.

Description	Age	Smokers	Non-Smokers	Pulse	Sys B.P	Diast B.P	BMI
(N=75)	(M ± SD)	N (%)	N (%)	(M ± SD)	(M ± SD)	(M ± SD)	(M ± SD)
Stone Crushers	28.04 ± 8.921	19 (25.3)	56 (74.7)	84.88 ± 17.830	135.33 ± 9.42	133.40 ± 9.42	24.70 ± 4.420
Control Group	30.79 ± 7.977	20 (26.7)	55 (73.3)	83.12 ± 16.404	122.48 ± 11.142	82.81 ± 13.321	24.98 ± 3.980
Frequency of Different Diseases							
Description	Anemia	Respiration	CVS	UTI	CNS	Miscellaneous	
(N=75)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Stone Crushers	2 (2.7)	21 (28.0)	5 (6.7)	N/A	N/A	Dry Cough 2 (2.7)	
Control Group	5 (6.7)	N/A	1 (1.3)	N/A	1 (1.3)	N/A	

Note: BMI: Body mass index; Sys B.P: Systolic blood pressure; Diast B.P: Diastolic blood pressure; M: Mean, SD: Standard deviation; CVS: Cardio vascular disease; UTI: Urinary tract infection; CNS: Central nervous system

**Table 2.** Peak expiratory flow rate comparison between stone crushers.

Description	PEFR				95% Confidence Interval for Mean		Minimum	Maximum	Related Sample Wilcoxon Signed Rank test
	N	M	SD	SE	Lower Bound	Upper Bound			
<b>Stone Crushers Workers Age Group</b>									
>5 Years	43	77.42	16.342	2.492	72.39	72.39	72.39	72.39	P<0.001
5-15 Years	30	79.87	17.451	3.186	73.35	73.35	73.35	73.35	
15 Years and>	2	80.5	6.364	4.5	23.32	23.32	23.32	23.32	
Total	75	78.48	16.523	1.908	74.68	74.68	74.68	74.68	
<b>Control Group</b>									
>5 Years	37	91.8	19.937	3.278	84.43	97.73	55	132	P<0.001
5-15 Years	31	78.03	15.329	2.753	72.41	83.65	55	119	
15 Years and>	7	99.29	25.973	9.817	75.27	123.31	64	132	
Total	75	86.45	19.983	2.307	81.86	91.05	55	132	

### DISCUSSION

The results of present study shows that the length of work experience to silica dust may not affect the lung function of stone crushers, because the mean value decreased in <5 years of work experience, little better in 5-15 years of work experience group and in the work experience group 15 years and above was normal.

Especially expressively diminished in the estimation of PEFR in all laborers when coordinated by routine with regards to control gathering [1,10-13]. The PEFR mean an incentive in existing examination was diminished in stone crushers however the PEFR mean an incentive in control gathering (overall public) was ordinary, which demonstrates PEFR esteem was preferable in control bunch over stone crusher. Show examine bolstered the finish of studies performed [12-15] and contradict the investigation performed [16].

The subjects who were presented to the dust for ≥ 2 years were found to have brought down PEFR than the individuals who were uncovered for <2 years. This is because of the bothering of upper respiratory tract mucosa because of delayed presentation bringing about the hypertrophy of the mucosal covering. This thusly brings about the expanded discharge of bodily fluid and development of mucosal attachments, which makes deterrent the breathed out air [1]. Great muscle withdrawal in youthful age

helps in removing a more noteworthy part of breathed in air in this way giving a higher pinnacle expiratory stream rate. In this way diminishment in top expiratory stream rate with expanding age might be because of the lessening in chest muscle withdrawal with the headway of age <sup>[4,17]</sup>. The estimation of FEF25-75% and PEFR in stone crushers of every one of the two ages bunches demonstrated profoundly huge lessening when contrasted with controls. Additionally found that the estimation of FEF25-75% and PEFR continues diminishing as the length of presentation to particulate issue increments <sup>[13]</sup>. However in the present investigation the lower PEFR in stone crushers than the control group. <5 years bring down PEFR was seen than 5-15 years and 15 years and >. The aftereffect of present examination opposing to the investigation performed by Tiwari et al. <sup>[4]</sup>.

PEFR is controlled by the weight applied in a constrained lapse and henceforth on energy of the expiratory muscle. PEFR is more exertion subordinate and is record of expiratory aviation route protection. Protein discharged from eosinophil in provocative response may add to the hyper responsiveness of aviation route.

Aggravation of upper respiratory tract mucosa because of delayed presentation of silica brings about hypertrophy of mucosal covering. This thus brings about expanded discharge of bodily fluid and arrangement of mucosal attachments, which makes hindrance, breathed out air <sup>[4]</sup>. These discouraged aviation routes fall more effectively than the ordinary aviation routes which brings about diminished development of air to the outside. This decreases the maximal expiratory stream. The hypertrophy and scarring - bronchial related lymphoid tissue and intrapulmonary lymph hub may likewise pack bigger aviation routes and perish in PEFR <sup>[17,18]</sup>.

### CONCLUSION

This study concluded that important difference found in the peak expiratory flow rate between stone crushers and control group. Stone crushers showed the mild restrictive lung deficiencies but the control group was normal and the results also shows that the length of work experience to silica dust may not affect the lung function of stone crushers.

### RECOMMENDATIONS

Particular assurance required, suitable mask have to be used and they should be wash away or the channel should be restored when necessary and their utilization must be clarified and supported through rehashed wellbeing training programs. Unique styles of shoes and garbs for this work are vital and intermittent spirometry test ought to perform. Building control measures, establishment of nearby fumes ventilation at the focuses freeing dust, jaw crusher, disintegrator and vibrating screen, utilization of sack channels and wet procedures ought to be taken. These specialists should be enlisted with the administrative government disability plans like "Employees State Insurance Scheme" (ESIS) and would be given wellbeing and different advantages.

### REFERENCES

1. Tiwari RR, et al. Spirometric measurements among quartz stone ex-workers of Gujarat, India. *J Occup Health*. 2003;45:88-93.
2. Ilyas M and Rasheed F. Health and environment related issues in stone crushing in Pakistan. *South Asia Network of Economic Research Institutes (SANEI)*. 2010;10-18.
3. Khan MM, et al. Health hazards and socioeconomic effects of stone crushing industry on its workers: A case study of Sargodha, Pakistan. *J Envi Agri Sci*. 2016;6:40-46.
4. Csavina J, et al. A review on the importance of metals and metalloids in atmospheric dust and aerosol from mining operations. *Sci Total Environ*. 2012;433:58-73.
5. Titi A, et al. Environmental effects of the open cast mining a case study: Irbid Area, North Jordan. *American Journal of Industrial and Business Management*. 2015;5:404-423.
6. Gottesfeld P, et al. Reduction of respirable silica following the introduction of water spray applications in Indian stone crusher mills. *Int J Occup Environ Med*. 2008;14:94-103.
7. Kamat S, et al. A study of pulmonary function among Indians and assessment of the Wright peak flow meter in relation to spirometry for field use. *Am Rev Respir Dis*. 1967;96:707-716.
8. Leitch AG. Functions of the lung. *Crofton and Douglas's Respiratory Diseases*. 5th edn. Blackwell, Oxford. 2001;26-62.
9. Mittleman RE and Wetli CV. The fatal cafe coronary: foreign-body airway obstruction. *JAMA*. 1982;247:1285-1288.
10. Ghotkar V, et al. Involvement of lung and lung function tests in stone quarry workers. *Ind J Tub*. 1995;42:155-160.
11. Johncy S, et al. Effect of occupational exposure to dust on pulmonary function in workers associated with building demolition. *Biomed Res*. 2011;22:241-247.
12. Rao NM, et al. Maximal expiratory flow volume values evaluation among female quartz grinders. *Indian J Occu Envi Med*.

2006;10:124.

13. Sivacoumar R, et al. Particulate matter from stone crushing industry: size distribution and health effects. *J Envi Eng.* 2006;132:405-414.
14. Singh SK, et al. Assessment of impact of high particulate concentration on peak expiratory flow rate of lungs of sand stone quarry workers. *Int J Environ Res Public Health.* 2006;3:355-359.
15. Rathod SB, et al. Pulmonary function tests in stone crushers. *Indian J Physiol Pharmacol.* 2014;58:300-303.
16. Merenu I, et al. The effect of chronic cement dust exposure on lung function of cement factory workers in sokoto, Nigeria. *Afr J Biomed Res.* 2007;10:139-143.
17. Nunn A and Gregg I. New regression equations for predicting peak expiratory flow in adults. *BMJ.* 1989;298:1068-1070.
18. Chierakul N, et al. Factors determining the severity of pulmonary function impairment in Silicotic Patients. *J Med Assoc Thai.* 2007;90:54-58.