

## The Effect of Marble Dust on Different Pulmonary Parameters in Marble Factory Workers

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**Abstracts:** There are numbers of marble factories are found in Agra, UP, India and the numbers of workers perform their duties to those factories to maintain their family wages. Majority of the workers are habituated to smoke during their working period. The marble dust as well as smoking habits both affects the pulmonary parameters. Therefore an attempt has been taken to find out the severity of the affect of dust on pulmonary parameters in marble factory workers with respect to nonsmokers and residing far away from the marble factories, i.e., persons residing in Bareilly, UP, India. The study was performed on 90 male marble factory workers in which 62 workers with smoking habits and 28 workers are nonsmokers. And they are compared with 20 smokers and 20 non-smokers subjects, which are denoted as control group, considering same economic status. The subjects' height and weight were taken following the standard procedure. The pulmonary parameters [Forced Vital Capacity (FVC), Forced Expired Volume-1<sup>st</sup> sec. (FEV<sub>1</sub>), Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow (FEF<sub>25-75%</sub>) and Maximum voluntary ventilation (MVV)] were determined by means of a portable multifunctional computerized spirometer. The results indicates that there was a significant difference in FVC ( $p < 0.001$ ) and FEV<sub>1</sub> ( $p < 0.01$ ) between control group and marble workers with smoking habits. It may be concluded that the workers of marble factories are directly affected from the dust of marble during working as well as non working period also, due to they were residing near the marble factories. This direct effect of the workers due to the inhalation of marble dust through the respiration, which might be causes restrictive or obstructive lung diseases.

**Key words:** Marble factory workers, Smokers, Non smokers, Pulmonary parameters. [Ahmed Q R et al. NJIRM 2011; 2(3) : 07-10]

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**Introduction:** Exposure to marble dust occurs across a range of marble factories and the worker involved in cutting and transportation of stone. In India, the stone cutting units are an unorganized sector of the countries. The numbers of workers are small in each unit. The workers usually inhale a large amount of dust generated by the cutting units, and this dust contains silicon dioxide or free silica. Free silica is responsible for causing the occupational diseases, silicosis and so on. Silica refers to the chemical compound silicon dioxide (SiO<sub>2</sub>), which occurs in a crystalline or non crystalline (amorphous) form. Crystalline Silica may be found in more than one form (polymorphism). The polymorphic forms of crystalline silica are alpha quartz, beta quartz, Tridymite, cristobalite, keatite, coesite, stishovite, and moganite.<sup>1, 2, 3</sup>

Due to the continuous exposure of marble dust can causes obstructive or restrictive lung diseases. It may increase the hyper responsiveness of bronchial mucosa, dry cough etc. The restrictive lung disease results in decrease in vital capacity and pulmonary parameters depending upon the duration of exposure to the marble dust. The previous studies indicate that the stone crushing factory workers and agricultural workers suffers from pulmonary impairment due to dust particle in the environment<sup>4</sup>. The marble factory workers mainly involved in cutting and transportation of marble plates. That is why they were remain exposed in marble dust during working as well as non working time period also. The marble dust particles have high concentration of silica. Associated with a history of high exposures from tasks that produces small particles of air borne dust with a high silica content, Such as sand

blasting, rock drilling, or quartz Milling.<sup>5</sup> Pulmonary fibrosis may not be present in acute silicosis.<sup>6</sup> Epidemiologic studies of gold miners in South Africa, granite quarry workers in Hong Kong, Metal miners in Colorado and coal miners in Scotland have shown that chronic silicosis may Develop or progress even after occupational Exposure to silica has been discontinued.<sup>7,8,9,10,11,12</sup>

Therefore, it is of important to study the pulmonary function status of marble factory workers to determine the magnitude of pulmonary problems among stone cutting workers, and to compare their pulmonary function status with that of subjects not exposed to marble dust. And it has also been aimed to find out whether there were any effects of smoking habits on pulmonary parameters or not.

**Material and Methods:** SELECTION OF SITE AND SUBJECT: The marble factories are mostly present in Agra, UP and the workers are basically residing near the marble factories of the Agra. Therefore the workers are selected randomly from those factories, who are working from last five years or more. Only the male subjects were considered for this study. The age range of the subjects was 20 to 50 years. The subject was priorly informed about the study and the consents of all subjects were taken before including them in the study. The subjects were also divided in to two groups viz., marble workers with smokers (n=62) and marble workers with nonsmokers (n=28). The subjects of the control group are selected from those who are residing far away from the marble factories of Agra i.e., from Bareilly, UP. And they are also divided into two groups i.e., smokers (n=20) and nonsmokers (n=20) those who are physically fit and free from any type of pulmonary diseases. A prepared proforma was designed to evaluate and record the personal data of all 130 subjects asking their name, age, sex, height and weight, personal history like smoking, with duration and quantity, any history of lung disease, history of persistent cough etc. History of hypertension, allergy and diabetics were also taken for excluding of the subject.

**PULMONARY CAPACITY :** The pulmonary function tests or pulmonary capacity of the subjects were

determined by means of a portable multifunctional computerized spirometer (Sl. No. A-23-050.0883). By this instrument Forced Vital Capacity (FVC), Forced Expired Volume-1<sup>st</sup> sec. (FEV<sub>1</sub>), Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow (FEF<sup>25-75%</sup>) and Maximum voluntary ventilation (MVV) of the subjects were measured. Determination of the pulmonary capacity was done according the procedure as per manufacturer's Manual.

**DATA ANALYSIS :** The all data were analyzed with the help of a software package on 'STATISTICA' (Version 8.0). The mean and standard deviation was calculated for all data. The 't'-test and 'p' values among different groups of parameters had also been made.

**Result:** The pulmonary parameters Forced Vital Capacity (FVC), Forced Expired Volume-1<sup>st</sup> sec. (FEV<sub>1</sub>), Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow (FEF<sub>25-75%</sub>) and Maximum voluntary ventilation (MVV) which were taken from the worker of marble factories and control groups are presented in the Table -1. The result indicates that there is significant difference between worker of marble factories and control groups with smoking habits.

There was a significant difference in FVC (p<0.001) and FEV<sub>1</sub> (p<0.01) between the smokers of marble workers and control group. The significant difference also noted in FVC (p<0.05) of nonsmokers of marble workers and control group but the level of significance was lower than that of the smoker groups. This indicates that there was a direct effect of marble dust on pulmonary parameters on those who are working continuously in marble factories with smoking habits.

**Discussion:** In the present study denotes that the marble dust content silica which may causes pulmonary fibrosis which is also found in the others study, which state that silicosis most commonly occurs as a diffuse Nodular pulmonary fibrosis.<sup>13,14</sup> This lung disease (which is sometimes asymptomatic<sup>7</sup> is caused by the inhalation and deposition of respirable crystalline silica particles (i.e., particles<10µm in diameter).<sup>13,14</sup>

**Table I:** Comparison of pulmonary parameters of control group and marble factory workers.

GROUP	PARAMETER	FVC (L)	FEV <sub>1</sub> (L)	FEV <sub>1</sub> /FVC	PEFR (L/min)	FEF <sub>25-75%</sub> (L/min)	MVV (L/min)
SMOKER	Control (n=20)	2.661 ±0.455	2.109 ±0.420	80.758 ±19.681	5.354 ±1.821	2.775 ±0.431	88.878 ±23.175
	Marble (n=62)	2.225 ±0.622	1.798 ±0.413	86.171 ±29.426	4.765 ±1.789	2.656 ±0.912	87.612 ±30.951
	p level	0.001	0.007	0.353	0.216	0.430	0.847
NON SMOKER	Control (n=20)	2.729 ±0.581	2.054 ±0.434	76.384 ±14.127	5.364 ±1.588	2.881 ±0.633	92.813 ±26.120
	Marble (n=28)	2.361 ±0.676	1.853 ±0.388	82.012 ±19.980	4.918 ±1.790	2.834 ±0.765	91.035 ±26.917
	p level	0.050	0.107	0.259	0.368	0.816	0.820

There was no such significant difference was noted in PEFR, FEF<sub>25-75%</sub> and MVV in smoking and nonsmoking marble workers with respect to control smoker and nonsmoker group. This indicates that the duration of 5 yrs. smoking habit does not play any direct role in development of silicosis. According to a report from the U.S. Surgeon General, cigarette smoking has “no significant causal role” in the etiology of silicosis. Probably the most important factor in the development of silicosis is the “dose” of respirable silica-containing dust in the work place setting that is, the product of the concentration of dust containing respirable silica in work place air and the percentage of respirable silica in the total dust.<sup>15</sup>

Other important factors are - the particle size, the crystalline or non crystalline nature of the silica, the duration of the dust exposure and the varying time period from first exposure to diagnosis (from several months to more than 30 years).<sup>8,11,16,17,18</sup> Such exposure situations may include work processes that produce freshly fractured silica surfaces<sup>19</sup> or that involve quartz contaminated with trace elements such as iron.<sup>20</sup> The present study performed on those workers who are performing their duties in marble factory since last five years. Thus the result does not show severe significant difference in pulmonary parameters except FVC and FEV<sub>1</sub>. The value of FVC and FEV<sub>1</sub> indicates that in long term exposure of the marble factory workers may suffer from pulmonary diseases.

Prolonged exposure to high levels of silica causes silicosis and increases the risk of developing chronic obstructive pulmonary disease (COPD) risk varies depending on the presence of other minerals in the dust, particularly clay minerals and the size of the particles and percentage of quartz. The effect of cumulative silica dust exposure on airflow obstruction is independent of silicosis.<sup>21</sup>

**Conclusion :** It may be concluded that short term exposure to marble dust does not play any role in generation of pulmonary disease. Although the smoking habits also play an important role for the development of pulmonary diseases but along with marble dust the development of pulmonary diseases occurs earlier than that of the nonsmoker’s marble factory workers. Therefore it

is suggested that if the marble factory workers use the mask or taping the towel over the mouth and nose they can protect themselves from exposure to dust. The workers who are habituated to smoking are also advised to minimize or leave their smoking habits to reduce the risk of pulmonary diseases.

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