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Lung Function Test in Quarry Workers

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Abstract:
Aim: To study the Lung functions test in stone Quarry workers. Materials & methods: The study was carried on 100 workers. 50 young males 20-35 yrs old, non smoking workers without any pre existing cardio-pulmonary disorders, exposed to silica dust for duration of 1-20yrs in a stone quarry worker in Rayachoty area, served as subjects. Another 50 males who were similar in all aspects to the study group, not exposed to silica dust professionally at any time, served as controls. Results: FVC, FEV1, PEFR & FVC % were highly significant and lower in stone quarry workers. FEV6 is significantly lower compared with controls Conclusion: Exposure to these substances, hitherto unaccustomed, led to development of a new set of disorders which can now be classified under 'Occupational Diseases'. Occupational exposure to silica dust leads to development of various pulmonary disorders, by sinosis begin most important of them.

1. Introduction

I have observed the majority of people working in the quarry's suffering from difficulty in breathing so I have interested in perform lung function test on those individual. Silica is the main component in sand & in rocks like sandstone and granite. Silica dust is usually created when such building products, sand stone or rocks are cut, drilled or worked on in a way that creates fine particle of silica in the air. It is breathing in this crystalline form of silica that causes silicosis. Silicosis is not a naturally occurring disease. Stone quarry workers form an unorganized sector of industry scattered all over India.

Various procedures and operations are involved in this work viz. stone cutting, loading and crushing. The most common form of silicosis develops after long Exposure to relatively low concentrations. Once the disease has begun, it will continue to progress even if the worker is removed from further exposure. There is no medical treatment for silicosis. People with silicosis are also at greater risk of developing lung cancer. Larger particles are usually prevented from reaching the lungs small air sacs. It is the smaller particles (less than 5thousands of a millimeter) that are most dangerous. The scarring of the lung causes stiffening, which will obstruct breathing and cause shortness of breath. This can lead to permanent heart and lung diseases.

2. Materials and Methods

2.1. Source of the Data

The study was carried out at stone quarries situated in Rayachoty area 45kms away from the Kadapa. The subjects for this study consisted of 100 workers. 50 young males 20-35 yrs old, non smoking workers without any pre existing cardio-pulmonary disorders, exposed to silica dust for duration of 1-20yrs in a stone quarry worker in Rayachoty area, served as subjects. Another 50 males who were similar in all aspects to the study group, not exposed to silica dust professionally at any time, served as controls.

2.2. Methods of Collection

All the selected subjects were asked to come to the Laboratory of department of physiology, Fathima Institute of Medical Sciences, Kadapa, Andhra Pradesh. All the tests were conducted in good ventilation at room temperature. Pulmonary function tests were carried out on stone quarry workers and controls using 'super Spiro SPL-95'. The data obtained was analyzed by using student't' test. The relation between changes in pulmonary functions and duration of exposure was obtained by co-relation analysis. The following Lung function parameters are provided by the Super Spiro:

- Forced Expired Volume in 0.75 seconds (FEV.75)
- Forced Expired Volume in 1 seconds (FEV1)
- Forced Expired Volume in 3 seconds (FEV3)
- Forced Expired Volume in 6 seconds (FEV6)
- Forced vital capacity (FVC)
- Forced vital capacity % (FVC %)
- Peak Expiratory flow capacity (PEF)

2.3. Observations

Group		N	Mean	Std. Deviation	Std Error Mean	P-Value	Inference
Age	Cases	50	37.76	11.752	1.662	0.001	S
	Controls	50	46.75	8.052	1.800		
Height	Cases	50	165.66	7.102	1.004	0.487	NS
	Controls	50	164.35	7.066	1.580		
Weight	Cases	50	63.38	14.115	1.996	0.662	NS
	Controls	50	64.70	10.032	2.243		
BMI	Cases	50	23.17	4.927	0.697	0.49	NS
	Controls	50	23.88	3.358	0.751		

Table 1: Comparison of Anthropometrics Measurement between Cases and Controls

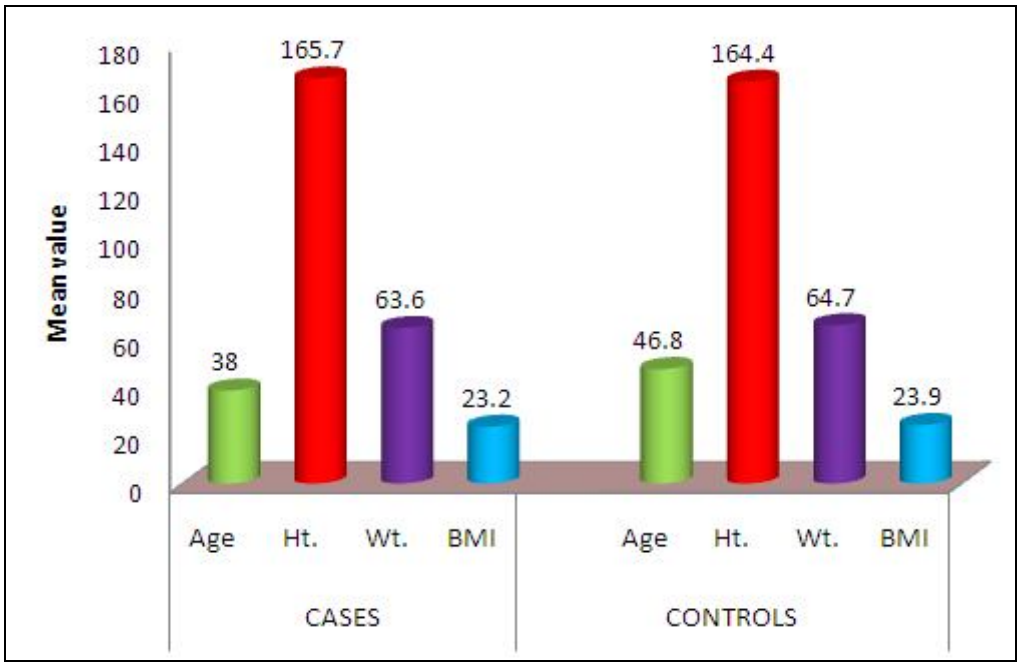

Figure 1

From the above table shows that there is a significant (S) difference in age between cases & controls. There is no significance difference (NS) in Ht, Wt, & BMI. The mean age was found to be more (46.75) in controls when compared to cases.

Group		N	Mean	Std. Deviation	Std Error Mean	P-Value	Inference
FVC	Cases	50	1.8078	0.709	0.100	0.000	HS
	Controls	50	3.0160	0.402	0.900		
FVC 1	Cases	50	1.7086	0.722	0.102	0.000	HS
	Controls	50	2.5830	0.440	0.098		
FVC 3	Cases	50	2.5014	1.075	0.152	0.068	NS
	Controls	50	2.8300	0.405	0.090		
FVC 6	Cases	50	2.5228	1.048	0.148	0.007	S
	Controls	50	3.0010	0.382	0.0855		
PEF	Cases	50	2.9058	1.156	0.1633	0.000	HS
	Controls	50	5.8100	2.157	0.482		
FEV %	Cases	50	43.80	15.475	2.188	0.000	HS
	Cases	50	82.85	7.95	1.779		

Table 2: Comparison of Parameters Measurement between Cases and Controls

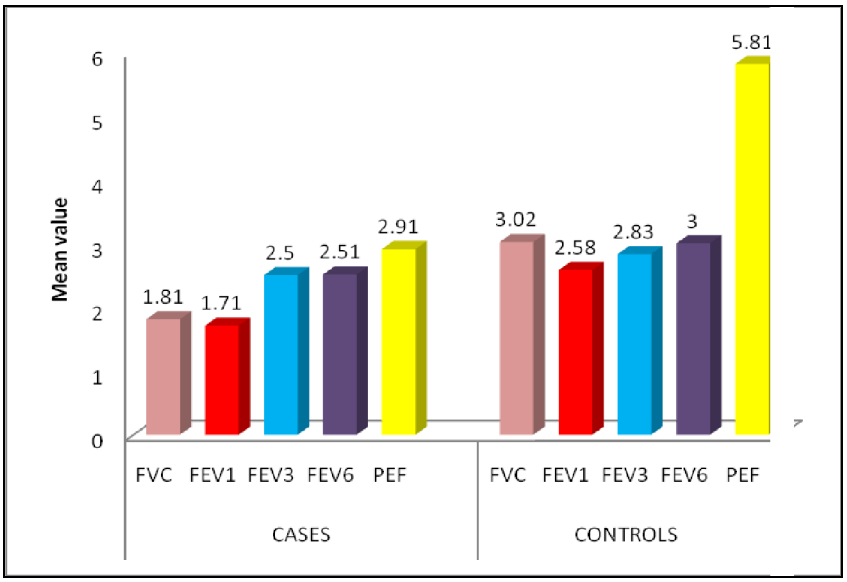

Figure 2

From the above table shows that there is a highly significant (HS) difference in FVC, FEV 1, PEF & FVC %. Significant in FEV 6 & there is no significant difference in FEV 3 between cases & controls ie the mean FVC, FEV, FEV 6, PEF & FVC% was found to be more in controls when compared to cases.

Work Group	N
CRUSHING	30
CUTTING	10
LOADING	10

Table 3: Nature of Work in Cases

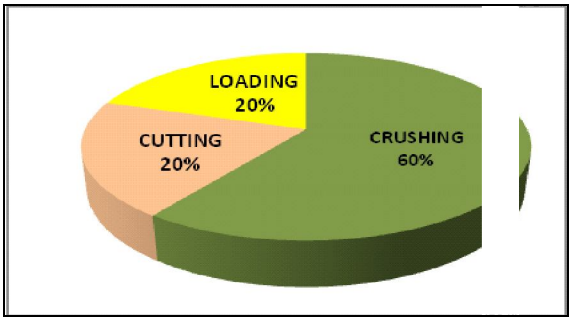

Figure 3: Nature of Work in Cases

Group		N	Mean	Std. Deviation	Std Error Mean	P-Value	Inference
Age	Crushing	30	35.07	11.983	2.188	0.09	NS
	Cutting	10	39.40	11.207	3.544		
	Loading	10	44.20	9.508	3.007		
Height	Crushing	30	165.37	7.819	1.428	0.912	NS
	Cutting	10	165.70	5.599	1.770		
	Loading	10	166.50	6.721	2.125		
Weight	Crushing	30	60.30	15.146	2.765	0.115	NS
	Cutting	10	65.30	13.064	4.131		
	Loading	10	70.70	8.920	2.821		
BMI	Crushing	30	22.14	5.188	0.947	0.151	NS
	Cutting	10	23.92	5.110	1.616		
	Loading	10	25.51	3.013	0.953		

Table 4: Comparison of Anthropometric Measurement in Cases between Crushing, Cutting, & Loading

From the above table shows that there is a no significant (NS) difference in Age, Ht, Wt and BMI between the natures of the work group.

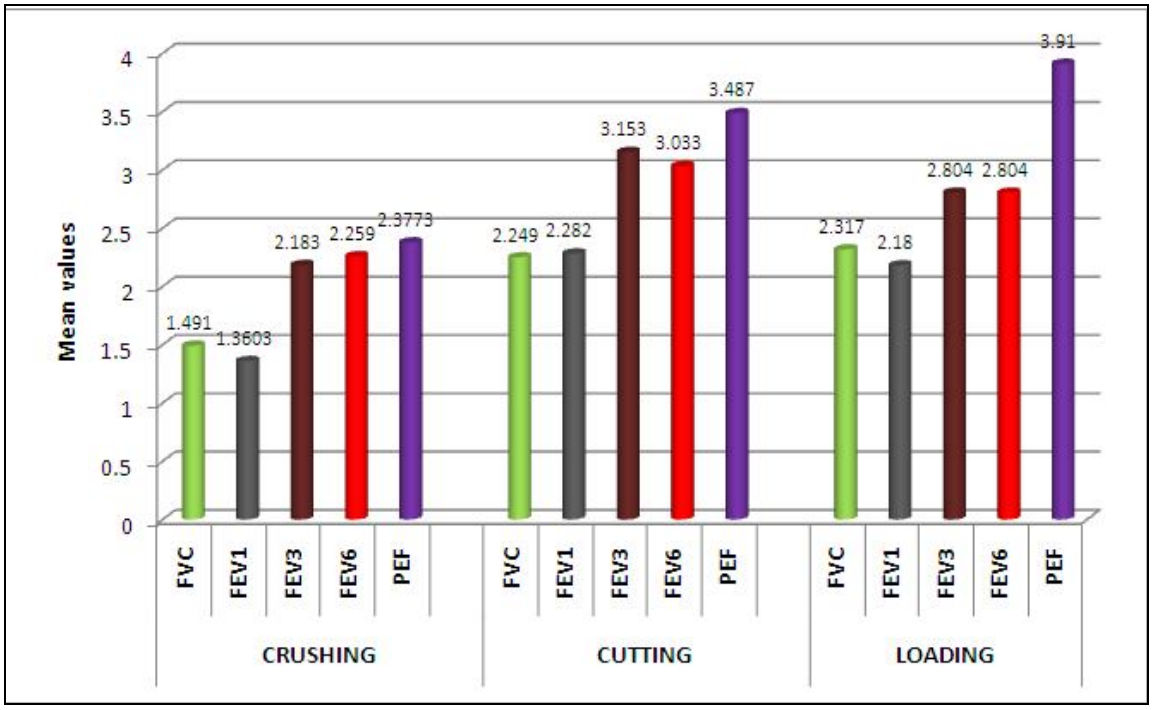

Figure 4: Comparison of Parameters Measurement in Cases between Crushing, Cutting & Loading

There is highly significant difference in FVC, FEV1, PEFR and FVC%. There is a significant difference in FEV3 and there is no significant difference i FEV 6 between the nature of the work group. The mean value of FVC, FEV1, FEV3, FEV6, PEF, FVC% was found to be less in crushing when compared to cutting and loading.

	FVC		FEV1		FEV3		FEV6		PEF	
Dust Exposure	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
<5(23)	2.1374	0.476	2.010	0.320	3.034	0.421	2.989	0.44	3.443	0.843
5-10(17)	2.0318	0.450	1.996	0.593	2.913	0.615	3.002	0.55	3.215	0.810
10-15(8)	0.6975	0.111	0.537	0.126	0.578	0.125	0.640	0.11	1.117	0.055
15-20(2)	0.5550	0.077	0.470	0.098	0.555	0.063	0.615	0.007	1.25	0.212

Table 5: Dust Exposure

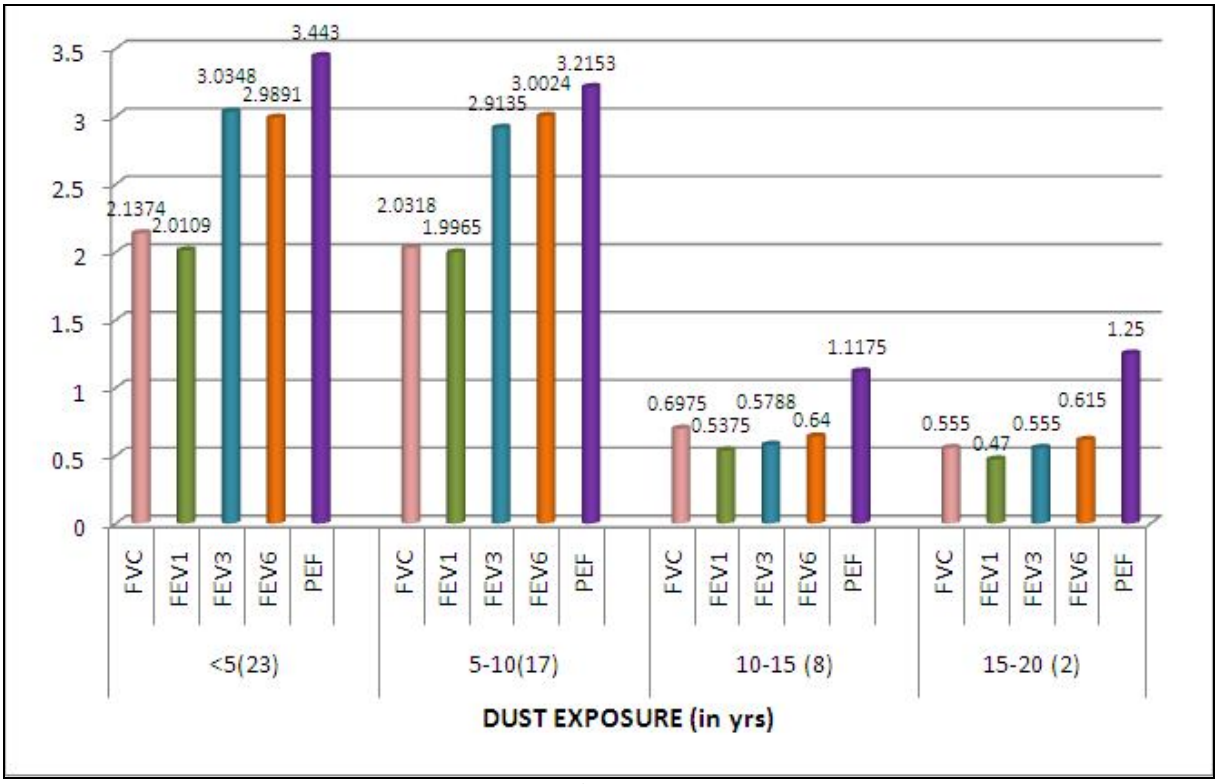

Figure 5

3. Discussion

This study was done to observe the effects of silica dust on the pulmonary functions in quarry workers exposed to silica dust for 1-20 years. Non-smoking quarry workers with no pre-existing cardio-respiratory diseases were selected for the study. Many studies on lung function test were reported in literature. P. Malenberg et al (1993) conducted a cross-sectional study on granite crusher workers. He observed that decreased forced expiratory volume in FEV1 in granite crushers. Bushra Iftikar, Mohammed Hussain Khan et al (2009) had conducted a cross-sectional study on the relationship between silica dust exposure & COPD in workers of dust granite industries. They concluded that the majority of respondents who were exposed to silica dust for 10 years or more had respiratory problems. Merenu IA et al (2007) studied the vital capacity and FEV1 were significantly reduced in workers exposed to dust relative to the unexposed to dust impairs lung functions. Davis GS et al (1986) reported that inhalation of silica in crystal form is a well known of the pneumoconiosis, silicosis. D Taleni et al (1995) had conducted a study on chest radiography and high resolution computed tomography in the evaluation of workers exposed to silica dust.

In present study, FVC, FVC%, FEV1 & PEFR were highly significantly & less in quarry workers as compared to controls. FEV6 is significantly less in quarry workers as compared to controls. FEV3 is compared with controls it did not shown any variations. FVC, FVC%, FEV1 & PEFR was highly significantly reduced than FEV6. There were significant reductions in FVC & FEV1 in the workers in comparison to normal healthy controls. It is as per the study made by JM Peters, TJ Smith et al in 1984. According to their study quarry workers had lower FVC, FEV1 than the non workers.

Decrease in FVC, FVC%, FEV1, FEV3 & PEFR in stone quarry workers as compared to controls hints towards an **obstructive** nature of respiratory pathology. Low FVC, FEV1 & PEFR values which are flow rates at high lung volumes indicate that probably the larger airways are affected first in the pathology caused by silica dust.

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4. Conclusion

Exposure to these substances, hitherto unaccustomed, led to development of a new set of disorders which can now be classified under 'Occupational Diseases'. Occupational exposure to silica dust leads to development of various pulmonary disorders, byssinosis begin most important of them.

4.1. Following Conclusion were drawn from the Study

1. Dynamic lung volumes and capacities (FVC; FEV1, PEFR & FVC %) were highly significant and lower in stone quarry workers. FEV6 is significantly lower compared with controls.
2. Flow rates at higher lung volumes (PEFR) were lower in stone quarry workers.
3. Above results pointed towards obstructive airway pathology, probably affecting the larger airways in stone quarry workers.
4. More the duration of exposure, more is the dust and more is the decline in FEV1, FEC & PEFR. Function implies the severity of the obstruction depends on the duration of exposure to the dust

5. We conclude that even a short duration of exposure of 1-5 yrs, produces changes in the lung functions of stone quarry workers exposed to silica dust. Pre cautions have to be taken to prevent the development of a chronic, irreversible lung disease in the workers.

6. References

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