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# Comparative study of lung function among control group and workers of different pollutant industries

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***Abstract** : **Background:** This study was designed to evaluate the status of lung function among workers of four different pollutant industries. **Objective:** To determine the effect of pollutants on lung function parameters of exposed subjects (individuals) from four different pollutant industries. **Methods:** The study was carried out with 120 individuals, out of whom 40 were control group (not exposed to pollutant industries) and 80 were exposed group of workers from four different pollutant industries. The pulmonary function tests were carried out by dry type computerized schiller's spirometer. Questionnaire in standard format was given to all the participants to fill up the required data. **Results:** The result shows reduction of pulmonary function parameters FVC, FEV1, FEV1 % and PEFR in the exposed group of individuals among the study participants.*
***Conclusion:** The pulmonary function parameters were lower in individuals working in pollutant industries.*
***Keywords:** Control group, Exposed group, Lung function test, Pollutants, Study population*

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## I. Introduction

The occupational dust contains different types of pollutants which can affect the pulmonary health among individuals. Sources of air pollutants include saw dust, automobile spray painting, diesel exhaust, emission particles of crusher industry. The health condition of workers of stone quarry industry is a known fact (Oxman et. al. 1993; British Research Council 2007). The various studies have shown the adverse effect of exposure to dust on lung health (Oxman et. al. 1993). The dusty environment can have bad effects on lung health (Park K. 2007), like acute and chronic lung diseases (Kasper et. al. 2008). According to a study (Urom et. al. 2004), various health related complaints were observed in exposed subjects of stone quarry workers (Tsin et. al. 1987; Malmberg et. al. 1993). The workers of spray painting were reported to have occupational asthma due to exposure to diisocyanate (Chattopadhyay 2007). The workers exposed to spray painting may develop acute and allergic bronchial disease which results in reduction of pulmonary indices (Abelfad et. al. 2010). The various studies showed direct effects of exposure to diesel exhaust in the cardio-respiratory system affecting lung variables (Salvi et. al. 1999). Long duration of exposure to saw dust may cause occupational asthma of the workers (Meredith & Norman 1996). The substances present in wood dust may also affect the lung function variables of exposed group (World Health Organization, 1996). These substances cause various physical impairments of skin, throat and chest and further lower the lung function variables (Schlussen et. al. 2002). Very few studies have been carried out in North East India on the effect of industrial pollutants on lung indices. Therefore, this study was conducted to find out the effect of stone crusher dust, sawmill dust, automobile spray paints and diesel exhaust on lung function indices. The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

## II. Materials and method

An analytical cross-sectional study was conducted in the Department of Physiology, Silchar Medical College, Silchar (SMC), Assam, India. Approval was obtained from the Institutional Ethical Committee. The information in written consent was obtained from all the subjects.

**Sample design**

A sample size of 120 individuals was selected for this study. Out of 120 individuals, the unexposed group consisted of 40 individuals and exposed group consisted of 80 individuals. Only non-smoker subjects without any history of respiratory illness like bronchitis, bronchial asthma included in the present study. The 40 subjects of non-exposed group were randomly selected from among the staffs and students of Silchar Medical

College, Silchar, Assam. The exposed groups were selected from four different industries. The four different industries were stone crusher industry, sawmill, automobile spray paints industry and diesel workshops. A total of 20 individuals were selected from each industry. The industries were located within an average distance of 20 km from the Silchar Medical College. A structural questionnaire was given to all the subjects for recording personal data, age, gender, occupation, consumption of alcohol etc. Anthropometric measurements such as weight was measured by using a standard weighing scale, height by a stadiometer and BMI (Body mass index) by using Quetelet index.

Lung Function Tests

The lung function tests were performed by using Schiller's dry type computerized spirometer. The lung function parameter was tested between 9 – 11 am after light breakfast. The maneuver was explained to all the subjects. The subjects were directed to take deep inhalation followed by rapid and forced expiration into the instrument. At least 3 maneuvers were performed in the standing position using nose clamp during expiration. The best reading out of these three readings was accepted for the analysis. The parameters studied were FVC, FEV1, FEV1% and PEFR.

**Statistical analysis**

The data were analyses to estimate the mean and standard deviation of all the variables. The difference between groups was tested by using unpaired student t-test. The P-value at <0.05 was considered as the level of significance for t-test.

## III. Results

Out of 120 cases, 80 subjects were considered as the exposed group which belongs to workers and 40 were regarded as the control group with staff and students of Silchar Medical College, Silchar in this study. The results of the studies of pulmonary function indices in different pollution industries for workers are shown in the tables.

Data indicated (table no. 1) age and anthropometric parameters and BMI of control and exposed subjects of stone crusher industry and found no significant difference between two groups, except lung function parameters. FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in 1st second), FEV1% (FVC/FEV1%) and PEFR (Peak Expiratory Flow Rate) were found to be lower in exposed subjects and the difference was statistically significant.

**Table no.1: Age, anthropometric and lung function parameters of control and exposed subjects of stone crusher industry.**

| Parameters | Control group mean±SD | Crusher dust mean±SD | t-value | P-value | Significance (S) |
|---|---|---|---|---|---|
| Age(years) | 37.72±9.43 | 35.25±13.64 | -1.12 | 0.118784 | P>0.05(NS) |
| Height(cm) | 162.22±6.41 | 160.95±7.70 | -1.39 | 0.086309 | P>0.05(NS) |
| Weight(kg) | 55.35±9.85 | 54.85±9.40 | 1.13 | 0.132779 | P>0.05(NS) |
| BMI(kg/m²) | 20.62±2.95 | 20.70±2.55 | -0.24 | 0.40581 | P>0.05(NS) |
| FVC(L) | 3.77±0.13 | 2.15±0.47 | -15.88 | <0.00001 | P<0.05(S) |
| FEV1(L) | 2.73±0.81 | 1.38±0.96 | -5.62 | <0.00001 | P<0.05(S) |
| FEV1% | 84.91±15.43 | 74.10±21.76 | -1.98 | 0.026227 | P<0.05(S) |
| PEFR(L) | 4.79±2.58 | 3.31±1.45 | -2.84 | -0.003106 | P<0.05(S) |

Data showed (table no. 2) age and anthropometric parameters and BMI of control and exposed subjects of Diesel workers and found that the difference was not statistically significant. FEV1% was found to be lower in exposed group, but was not statistically significant. The PEFR (Peak Expiratory Flow Rate) was found to be higher in exposed group in the present study, but it was not statistically significant. However, lung function parameters FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in 1$^{st}$ second), were found lower in exposed subjects and the difference was found statistically significant.

**Table no.2: Age, anthropometric and lung function parameters of control and exposed subjects of Diesel workers.**

| Parameters | Control group mean±SD | Diesel worker mean±SD | t-value | P-value | Significance |
|---|---|---|---|---|---|
| Age(years) | 37.72±9.43 | 37.36±9.02 | -0.59 | 0.279341 | P>0.05(NS) |
| Height(cm) | 162.22±6.41 | 161.68±4.74 | -0.56 | 0.289383 | P>0.05(NS) |
| Weight(kg) | 55.35±9.85 | 55.72±8.85 | 0.38 | 0.353031 | P>0.05(NS) |

| | | | | | |
|---|---|---|---|---|---|
| BMI(kg/m²) | 20.62±2.95 | 20.59±3.47 | -0.05 | 0.4802192 | P>0.05(NS) |
| FVC(L) | 3.77±0.13 | 2.98±0.43 | -8.77 | <0.00001 | P<0.05(S) |
| FEV1(L) | 2.73±0.81 | 2.23±1.14 | -1.92 | 0.02989 | P<0.05(S) |
| FEV1% | 84.91±15.43 | 81.54±21.52 | -0.62 | 0.268843 | NS |
| PEFR(L) | 4.79±2.58 | 5.18±1.73 | 0.70 | 0.243363 | NS |

Data showed (table no. 3) age and anthropometric parameters and BMI of control and exposed subjects from saw dust workers. Lung function parameters FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in 1st second), and PEFR (Peak Expiratory Flow Rate) were found lower in exposed subjects and the difference was statistically significant. However, FEV1% found lower in exposed subjects was not statistically significant.

**Table 3: Age, anthropometric and lung function parameters of control and exposed subject of Saw dust workers.**

| Parameters | Control group mean±SD | Saw dust mean±SD | t-value | P-value | Significance |
|---|---|---|---|---|---|
| Age(years) | 37.72±9.43 | 37.70±11.31 | -0.01 | 0.496037 | P>0.05(NS) |
| Height(cm) | 162.22±6.41 | 162.20±6.12 | -0.2 | 0.421274 | P>0.05(NS) |
| Weight(kg) | 55.35±9.85 | 55.15±9.70 | -0.52 | 0.30304 | P>0.05(NS) |
| BMI(kg/m²) | 20.62±2.95 | 20.60±3.12 | -0.40 | 0.30304 | P>0.05(NS) |
| FVC(L) | 3.77±0.13 | 2.78±0.70 | -6.60 | <0.00001 | P<0.05(S) |
| FEV1(L) | 2.73±0.81 | 2.22±1.05 | -1.96 | 0.027403 | P<0.05(S) |
| FEV1% | 84.91±15.43 | 81.65±18.55 | -0.14 | 0.08342 | NS |
| PEFR(L) | 4.79±2.58 | 3.83±1.38 | -1.92 | 0.02989 | P<0.05(S) |

S= Significant, NS= not significant

Data showed (table no. 4) age and anthropometric parameters and BMI of control and exposed subjects of spray paint industry. Lung function parameters FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in 1st second), FEV1% (FVC/FEV1%) and PEFR (Peak Expiratory Flow Rate) were found lower in exposed subjects and the difference was statistically significant.

**Table 4**: **Age, anthropometric and lung function parameters of control and exposed subject of Spray paint workers**.

| Parameters | Control group mean±SD | Spray paints mean±SD | t-value | P-value | Significance |
|---|---|---|---|---|---|
| Age(years) | 37.72±9.43 | 37.71±7.04 | -0.007 | 0.497226 | P>0.05(NS) |
| Height(cm) | 162.22±6.41 | 162.26±6.33 | -0.02 | 0.472074 | P>0.05(NS) |
| Weight(kg) | 55.35±9.85 | 54.14±7.31 | -0.82 | 0.208665 | P>0.05(NS) |
| BMI(kg/m²) | 20.62±2.95 | 20.52±2.57 | -0.32 | 0.375361 | P>0.05(NS) |
| FVC(L) | 3.77±0.13 | 2.17±1.03 | -7.27 | <0.00001 | P<0.05(S) |
| FEV1(L) | 2.73±0.81 | 1.51±0.76 | -6.42 | <0.00001 | P<0.05(S) |
| FEV1% | 84.91±15.43 | 72.95±22.11 | -2.17 | 0.017058 | P<0.05(S) |
| PEFR(L) | 4.79±2.58 | 3.12±1.17 | -7.59 | <0.00001 | P<0.05(S) |

S=significant, NS=not significant

## IV. Discussion

The present study showed variation and significant reduction among lung function parameters FVC (Forced Vital Capacity), FEV1 (Forced Expiratory volume in 1st second), FEV1% (FVC/FEV1%) and PEFR (Peak Expiratory Flow Rate) in exposed subjects of stone Crusher industry. However, no significant difference was observed for age, anthropometric parameters and BMI in control and the four exposed subjects.

Sachin et. al. (2014) found a significant reduction in PEFR in stone crusher workers. Similar results were observed in various studies (Ghotkar et al. 1995; Singh et al. 2006; Sivacoumar et al. 2006; Tiwari et al. 2004; Rao Neliore et al. 2006; Johncy et al. 2011). However, the results were contradictory to Merenu et. al. (2007), where authors observed non-significant difference in PEFR. The study of Gupta et al. (1999) showed reduction of FEV1 and PEFR in stone quarry workers. Another study showed significant decrease in pulmonary function parameters (FVC, FEV1, FEV1% and PEFR) in exposed workers (Mirdha et. al. 2015). Kiran Kumar et al. (2014) further observed significant reduction in the mean values of FVC, FEV1, FEV1% and PEFR in exposed subjects of stone quarry workers.

In Diesel workers, lung function parameters FVC (Forced Vital Capacity) and FEV1 (Forced Expiratory Volume in 1stsecond), was found lower in exposed subjects and statistically significant. However, FEV1% (FVC/FEV1%) of exposed subjects was not significantly lower. Further PEFR (Peak Expiratory Flow Rate) of exposed subjects was found higher in exposed group of Diesel workers, though not statistically significant. But the study of Pakkala et al. (2014) found FVC, FEV1, FEV1% and PEFR to be low or high which had statistically significant difference in exposed subjects.The present study reveals that the lung function parameters like FVC, FEV1, FEV1% and PEFR values are valuable in the diagnosis of obstructive lung diseases in quarry workers.

In the present study, lung function parameters i.e. FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in 1st second), and PEFR (Peak Expiratory Flow Rate) were found lower in saw dust exposed workers and were statistically significant. However FEV1% was not significantly lower in exposed workers. In the study of Deshpande et al. (2014) it was reported that there was significant decline in FVC, FEV1, FEV1% and PEFR. Another study (Koh and Jeyaratnam 2004) showed a decline in lung function parameters in saw mill workers which may be due to the accumulation of dust in air passages.

In this study lung function parameters FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in 1st section), FEV1% (FVC/FEV1%) and PEFR (Peak Expiratory Flow Rate), were found significantly lower in exposed subjects (spray paint workers). Our results were similar to that of Whig et. al. (1994).

## V. Conclusion

The present study showed a significant reduction in lung function indices among exposed groups as compared to the control subjects. The objective was to conduct a study in the northeast region of India to assess the effect of pollutants on pulmonary health. It was evident from the study that that the pulmonary health is affected by different industrial pollutants. The present study showed the significant effect of different pollutants and could be useful to decide upon the safety measures to be undertaken to improve the pulmonary health among workers engaged in industries.

(10)

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Author Contribution: All the authors contributed equally in designing and implementing the study.

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## References

[1]. D Oxman.; D. C. F Muir.; H. S Shannon. et al. 1993. Occupational dust exposure and chronic obstructive pulmonary disease: A systematic review. Am Rev respire Dis.148: 38-48.

[2]. Medical Research Council, 1986. Respiratory Symptoms questionnaire. British Medical Research Council. London, England.

[3]. Park K. 2007. Occupational health. In Park's textbook of preventive and social medicine 18thed. Jabalpur: M/S Banarsidas Bhanot. 608-10.

[4]. D. L. Kasper; E Braunwald.; A. S. Fauci et al. 2008. Environmental lung diseases. In Harrison's Principals of internal Medicine 16thed. New York. Mac Graw Hil. 1521-7.

[5]. S.E. Urom; A. B. Antai; E. E. Osim 2004. Symptoms and lung function value in Nigerian men and women exposed to dust generating from crushing of granite rocks in calabar, Nigerian Journal of Physiological Sciences. 19: 41-7.

[6]. P. H. Hedenstrom.; B. M. Sundblad 1993. Changes in lung function of granite crushers exposed to moderately high silica concentration: a12 year follow up. Br J Ind Med. 50: 726.

[7]. T.W. Tsin; F. J. Okelly; S. L. Chan 1987. Survey of respiratory health of silica exposed gemstone workers in Hongkong. Am Rev Respir Dis. 135:1249.

[8]. O. Chattopadhyay 2007. Pulmonary Function in Automible Repair Workers. Ind J of Comm. Med. 32:1.

[9]. A. Abuelfadl; A. A. El-Ebiary; El. El-Maddah et al. 2010. Pulmonary Toxicity among car spray painters. J Forensic Med Clin. Toxicol. 18:51-63.

[10]. S. Salvi; A. Blomberg et al. 1999. Acute inflamatory responses in the airways and peripherial Blood after Short Term Exposure to Diesel Exhaust in Humen Volunteers. Am J. Resp.Cri. Car. Med. 159(3):702-709.

[11]. S. Meredith and H. Norman 1996. Occupational asthma:measures of frequency from four countries. Thorax. 51(4):435-440

[12]. World Health Organization. 1996. International agency for research on cancer. IARC monographs on the evaluation of carcinogenic risk to humans. Wood dust and formaldehyde. 62.

[13]. V. Schlussen; I. Schaumburg; N. T. Anderson et al. 2002. Nasal patency is related to dust exposure in wood workers. Occupational environ Med. 59(1):23-29.

[14]. S. B. Rathod; S. B. Mane; S. S. Handergulle; D. Keran 2014. Pulmonary function test in stone crusher. Ind J Phy Phar. 58(3):302-305.

[15]. V. B. Ghotkar; B. R. Maldhure; S.P. Zodpey 1995. Involvement of lung function tests in stone quarry workers. Ind J Tub. 42:155-160.
[16]. S. K. Singh; G. R. Chowdhury; G. Purohit 2006. Assessment of impact of high particulate Concentration on Peak Expiratory Flow Rate of lungs of sand stone quarry workers. Ind J Environ Pub Health. 3(4): 355-359.
[17]. R. Sivacoumar; R. Jayabalou; S. Swarnalatha; K. Balakrishnan 2006. Particulate Matter from Stone Crushing Industry: Size distribution and health effects. J Environ Engineer. 132(3): 405-414.
[18]. R. Tiwari; S. Yashwant; H. Saiyed 2004. Peak Expiratory Flow: A study among silica-exposed workers, India. Ind J occupa Environ Med. 8(1): 7-10.
[19]. N. M. Rao; R. Takiar; Y.K. Sharma 2006. Maximal expiratory flow volume values evaluation among female quartz grinders. Ind J occup Environ Med. 10(3):124-127.
[20]. S. Johncy; K. T. Ajay; G. Dhanyakumar; P. N. Raj; V.T. Samuel 2011. Effect of occupational exposure to dust on pulmonary function in workers associated with building demolition. Biomed Res. 22(2):241-247.
[21]. A. Merunu; F. B. O. Mojiminiyi; C. H. Njoku; M. T. O. Ibrahim 2007. The effect of chronic cement dust exposure on lung function of cement factory workers in sokoto, Nigeria. African Journal of Biomedical Research. 10: 139 – 143.
[22]. P. Gupta; M. Chaswal; S. Saxena 1999. Ventilatory functions in stone quarry workers of Rajasthan. Ind J. Phy Pharma. 4(4):496-500.
[23]. P. Mirdha; N. D. Soni; K. Choudhary; S. Solanki; R. Sagu 2015. Pulmonary function test in stone crusher plant workers. Sch.J.App. Med. Sci. 3(5C):1989-1991.
[24]. H. Kiran Kumar.; R. Mallikarjuna; B.Sharan; M.Singh; K. Bandihari; P.Sasikala; G.Shravyakeerthe et al. 2014. Deterioration of pulmonary function in stone quarry workers. Bio Med Research. 25(2):261-266.
[25]. A Pakkala.; C. P Ganaashree.; T. A Raghavendra. 2014. Comparative study of the effect of automobile pollution on pulmonary function tests of people who reside in high traffic density urban areas and relatively traffic free rural areas. CHRISMED J Health Res.1:180-183.
[26]. A Deshpande.; A Afshan. Effect of Chronic Exposure of Sawdust in workers employed. In Textbook of Public health, 4th edition, Oxford: Oxford University Press.1045-65.
[27]. J Whig.; B Bansal.; R Mahajan. 1994. Work place challenge spirometer response in polyurethane (isocyanate) paint. Ind J Chest Ds Allid Sci. 36(2):73-76.

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