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Original Article

Effect of Construction and Flour Mill Air Pollution in Rural Area

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ABSTRACT

Background: chronic obstructive pulmonary disease (COPD) is a seventh leading cause of death and disability in the worldwide. For better living we need civilization, under these unignorable inherent maladies particles affecting the people. India like traditional and developing countries is requiring two of the major works flourmill and constructions. Now we are searching how much this work affecting the works.

Materials and Methods: A cross-sectional study was undertaken for a period of 12 months with 15 clinically normal and 80 COPD subjects at the Govt.General Hospital, Kurnool and from small villages in and around of Kurnool, various flourmills and labourers for construction work, were divided into 6 groups based on the work and experience and target on the respiratory parameters.

Result: Flourmill (FW) and construction works (CW) respiratory parameters are compared with the normal subjects. The levels FVC (0.01, 0.00, 0.00, 0.00, 0.00) and FEV1 (0.22, 0.02, 0.00, 0.14, 0.06) which are more dependent on the volumes and capacities are reduced. The values of PEF (0.00, 0.00, 0.00, 0.00, 0.00) and PIF (0.51, 0.14, 0.09, 0.00, 0.00), which are more dependent upon the airways are very much reduced, because the effects of the pollutants are more on bronchial tree.

Conclusion: pulmonary function tests like FVC, FEV1, PEF, and PIF have been conducted on flourmill workers and construction workers for the levels are vary period of exposure. The results suggest that COPD is common in these workers and the changes are more related to the period of exposure. These respiratory disorders are preventable if proper precautions are taken either by decreasing the concentration of pollutants or by rehabilitation of patients since the disorders are more related to the period of exposure.

KEYWORDS: COPD, FVC, FEV1, PEF, PIF.

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INTRODUCTION

COPD is a leading cause of morbidity and mortality, as per the WHO estimation it is a seventh leading cause of death and disability in the worldwide [1]. It will reach the fifth position by 2020 [1]. As per the 2001 estimations prevalence was 1013 lakhs of population are affected in the world wide due to the air pollution. This evidence is always alarming situation is more attributable to pollution of the atmospheric air. For the better living civilizations is very important but under these we are over looking on the air pollution. With increasing industrialization and increase of automobiles, chemicals used in aerosols, the atmosphere is getting highly polluted; even smoking, construction work, flourmill

work also causes the air pollution [2]. Breathing of this polluted air causes the chronic Obstructive Pulmonary Disease (COPD) [3]. In this circumstances have a look in the air pollution. In this context early diagnosis of respiratory disorders is more important to prevent chronicity resulting in either fibrosis or emphysematous changes in lungs. It may be better understood that the air pollution is not only responsible for the maladies in adults but also capable of causing damage to the children's lungs insidiously [3].

India is traditional and developing country. Under the developing the major thing is construction. In the construction work lot of air will be pollute by the cement and sand mixing. Additionally automobiles in traffic adding more pollutants to the atmosphere, and using of fritisites, smoking, smoke from factories, chemicals etc. knowingly or unknowingly we are polluting the air. But this is causing the COPD to the humans and Indian's one of the traditional food is flour. On preparation of the flour some amount of air will be pollutes. This also affects the lungs causing the COPD [4]. Because of flour is a major food in the India so we can't avid the preparation of flour. But who are the persons working the construction and various industries like flourmill, tobacco, quarry, rice and textile may develop health problem not only due to generalized atmospheric pollution but also due to exposure to dust, which is specific to that particular occupation [5]. Of late stringent antipollution measures have been implemented in the above said of the industries making the problem of pollution slightly declining. But at the same instance control by means of legal procedures may not be possible to have any type of regulation on small scale establishment like flourmill and locations of construction of houses etc.

The chemistry of air pollution is complex and varies from place to place. Apart from gases like CO, SO2 etc, fine particles called aerosols can enter the trachea-bronchial and produce irritating effects in the respiratory tract. The chemical nature of these pollutants influences the degree of damage to the respiratory tract. When the person challenged by the polluted air, the respiratory system responds through some general mechanisms. The intensity of this response depend not only the sensitivity of the person but also on the acuteness or chronicity of the challenges [6-8]. Even when the intensity of the pollution is less, the chronicity of the exposure to such low level of the pollution makes it hazardous to health. When it exposed to the pollutants it response may be in the form of bronchospasm, cough, excessive production of mucus etc. [7] if it is chronic exposure leads to emphysema, fibrosis of the lungs i.e., chronic/ recurrent generalized airway obstruction [9].

Lung have its own defence mechanism from air pollution but this mechanism becomes inadequate leading to the developing various diseases like emphysema, fibrosis, pneumoconiosis, byssinossis etc depending upon the allergens [9]. From last one decade the pulmonary function test are graining important both in physical and Clinical Medicine. Evaluation of lung function is an invaluable screening test to identify patients with airflow obstruction and to monitor disease progress, to assess the response to treatment. The lung function test are blood gas analysis, measurement of lung compliance, air way resistance, ventilation perfusion ratio, are complex and are not available except in few hospitals in our country. So we need easily available procedures for routine clinical practice and field work. The use of single force expiration as a method of assessing ventilation capacity has become popular mainly because as pointed out by Kennedy (1935), it is a much simpler and less tiring procedure. The basis of most of the various single breath methods is the same the volume of air expired is measured against time. Perhaps the measurement of the patient's vital capacity and the recording of the expiratory spirogram, by which airway obstruction and restriction can be assessed, form the valuable tests. But these tests require cumbersome apparatus and electric supply. Hence attention had been directed to expiratory flow rate as a measure of ventilator capacity. PEFR is one the important lung function tests to evaluate the status of lung mechanism. Apart from PEFR, FEV1 is also a convenient and reliable way of estimating ventilation capacity.

To evaluate the observed PEFR, FEV1, knowledge of its range in normal subjects of same age group and body size is essential which is calculated from the nomogram developed for the same cross section of population.

With the recent introduction of computerized pulmonary function tests, the collection of the data is very simple and along with FVC, FEV1, PEFR, Peak inspiratory Flow Rate can also be obtained if the turbine attached is a bi-directional one. Inspiratory Flow Rate directly indicates the compliance of lung and gives a very good assessment of pressure changes in relation to the volume and velocity inflow air. With the advent of the sophistication and easily available computerized pulmonary function tests instruments, the effect of pollutant like dust particles can be easily assessed. Since the menace of pollution being more it is necessary for early diagnosis of the changes occurring in the Respiratory system so that proper preventive measures or treatment is possible. In developing countries like India construction and flourmill works is the main. Who are working under these they don't know how much they are affecting with air pollution occurs resulting in COPD. In some instances hypersensitivity reactions caused by the inhalation of these pollutants result in marked changes which can manifest in spite of rehabilitation of these people in different trade. Most of the cases are preventable if they take proper precautions in a work period. If the exposure to the pollutants occurs for a long duration the severity of the symptoms are also more. So it appears that there is necessity for a study of the changes in the pulmonary parameters because of these pollutants and the effect of long-term exposure. Earlier studies are available on flourmill workers of different part of the country, but lacking in our location where more prevail. In India, silicosis has been made a notifiable disease under the Factories Act 1948 and Mines act 1952. Few case reports in the past have referred to silicosis in flourmill workers in India [10]. However, its association with flour mill workers has not yet been established.

MATERIAL AND METHODS

A cross-sectional study was undertaken for a period of 12 months with group-I contains 15 clinically normal, in that 10 male, 5 female with the mean age value of 26.6 years, having a mean height of 163.4cm and body weight of 55.53kg. 80 chronic obstructive pulmonary disease (COPD) subjects at the Govt. General Hospital, Kurnool, Andhra Pradesh, India. and from small villages in and around of Kurnool, various flourmills (FW) and labourers for construction work (CW), out of these group-II 15 were flour mill workers with 1-10 years work exposure with age mean is 29.4 years, mean height 160.6cm and 50.06kg mean weight. Group-III 20 were flour mill workers with 10-15 years work exposure with age mean is 38.85years, mean height 160.25cm and 48.3kg mean weight. Group-IV having 20 were flour mill workers with more 15 years work exposure with age mean is 45.25years, mean height 157.25 cm and 48.35 kg mean weight. Group-V contains 10 were construction workers with 1-5 years work exposure with age mean is 31.7years, mean height 155.1cm and 46.1kg mean weight. Group-VI contains 1 were construction workers with 6-10 years work exposure with age mean is 48.86years, mean height 156.06cm and 48kg mean weight, and target on the respiratory parameters. Subjects clinically abnormalities of vertebral column, thoracic cage, neuro muscular Disease, Known cases of gross anemia, Diabetes, Bronchitis, Bronchiectasis, Emphysema, Malignancy, Drug addicts, tobacco chewers and smokers, undergone major surgery, people who normally get exposed to other pollutants other than what they are normally getting exposed were excluded from this study. Pulmonary function test are carried on Spirowin supplied by Genesis Medical systems of Hyderabad. PFT value like FVC, FEV1, PEFR, PIF and other parameters including predictable value can be obtained. There is provision for bi-directional turbine, Analog to Digital Converter (ADC) and computer. In a single maneuver all the PFT values can be obtained except for M.V.V. all the tests are carried at a time of the day i.e. 9.00am to 11.00am to minimize any diurnal variation. The recordings were done at room temperature in sitting posture, after 30min rest with 3time perform the procedure after feeding the anthro

pological parameters. The values are not varying for more than five percent in FVC and PEFR. These recordings are tabulated and subjected for statistical analysis. Means standard deviation and p-values are calculated.

RESULTS AND TABLES

Table 1: Showing the mean ± sd of the age, weight, height and body surface area of the participants in the study.

	NORMAL	FW 1-5	FW 6-10	FW >15	CW 1-5	CW 6-10
AGE	26.47 ± 8.92	29.40 ± 8.70	38.85 ± 6.26	45.25 ± 8.91	31.70 ± 2.71	48.87 ± 3.48
Height	163.40 ± 9.83	160.60 ± 6.75	160.25 ± 9.05	157.25 ± 7.83	155.10 ± 7.69	156.07 ± 10.03
Weight	55.53 ± 10.49	50.07 ± 8.31	48.30 ± 6.59	48.35 ± 6.46	46.10 ± 4.70	48.00 ± 5.42
BSA	1.59 ± 0.17	1.62 ± 0.13	1.58 ± 0.4	1.53 ± 0.10	1.44 ± 0.09	1.46 ± 0.12

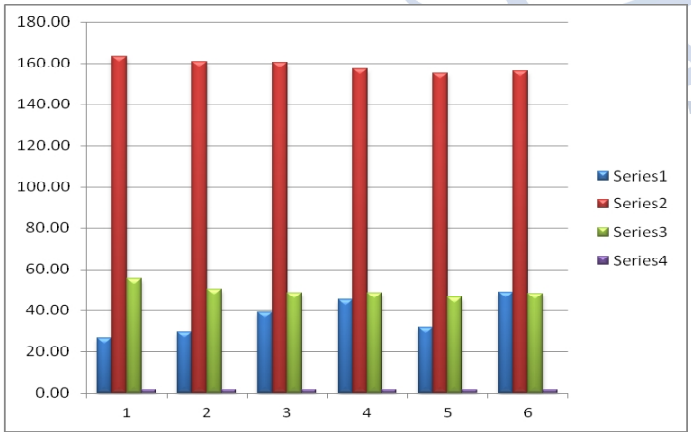
Table 2: Showing the mean ± sd of the FVC, FEV1, PEF and PIF of the participants in the study.

	NORMAL	FW 1-5	FW 6-10	FW >15	CW 1-5	CW 6-10
FVC	3.230 ± 0.573	2.691 ± 0.423	2.425 ± 0.657	2.086 ± 0.652	2.504 ± 0.412	2.0496 ± 0.396
FEV1	2.627 ± 0.575	2.398 ± 0.422	2.148 ± 0.570	1.615 ± 0.844	2.306 ± 0.405	2.281 ± 0.381
PEF	5.568 ± 1.671	3.793 ± 1.060	3.490 ± 0.601	3.375 ± 1.206	3.286 ± 0.358	2.357 ± 0.402
PIF	3.330 ± 0.788	3.145 ± 0.733	2.931 ± 0.758	2.753 ± 1.092	2.446 ± 0.249	1.978 ± 0.168

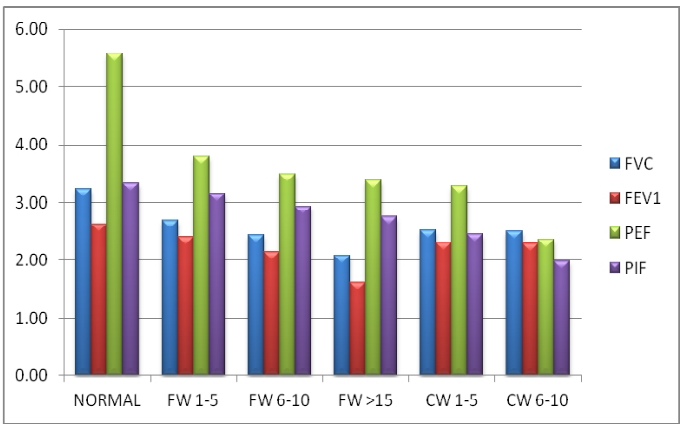
Table 3: Showing p-values of the FVC, FEV1, PEF and PIF of the participants in the study.

	FW 1-5	FW 6-10	FW >15	CW 1-5	CW 6-10
FVC	0.01*	0.00**	0.00**	0.00**	0.00**
FEV1	0.22	0.02*	0.00**	0.14	0.06
PEF	0.00**	0.00**	0.00**	0.00**	0.00**
PIF	0.51	0.14	0.09	0.00**	0.00**

* Statistical significant,
** statistically more significant. <0.05 is statistically significant.



Graph 1: Diagrammatic presentation, mean of the age, weight, height and body surface area of the participants in the study.



Graph 2: Diagrammatic presentation, mean of the age, weight, height and body surface area of the participants in the study.

DISCUSSION

The COPD cases are increasing day by day fastly along with the civilization under these children are more susceptible than adult according to lot of surveys undertaken [1]. These establishments by virtue of their presence in the residential localities are capable of causing hazards even in the essentially indoor population. As per the epidemiological survey air pollution causes of deterioration of number of pulmonary health indices. Due to air pollution increase incidence of cough 3.7%, bronchitis 2.5%, ear ache 1.6% times 1.5 to 2.1 folds asthma rate [11]. Experts are saying air pollution plays a major role in the development of cancer. Extracts of particulate pollution have been shown to be mutagenic in the human cell cultures [12]. Particulate matter is quite heterogeneous. Analysis of industrial particulates reveals hundreds of different particulates reveal hundreds of different materials including slicates, aromatic hydrocarbabons, acridines and possibly heavy metals. Therefore particulate matter from different sources may have vastly different effects on health [13].

Based on their immune system and small airway diameter and increased relative metabolic rate children are more susceptible persons [14]. Apart from particulate matter pollutants can have biologically active endotoxins. It has been shown by GLENCHECK that bacterial endotoxins can elicit profound immunotoxic and immunomodulating effects in vitro and in vivo and therefore can exacerbate adverse pulmonary reactions to gain dust. Coming to the flourmill workers they are more exposed to the dust of flour which contaminated including silica, fungi, and their metabolites (aflatoxin), bacterial endotoxins, insects, mites, mammalian debris and various chemical additives such as pesticides and herbicides it lead to development of respiratory disease [15-16]. In other hand that are working for construction it very dangers, because mixing of sand and cement is the silica flour. Which is a air pollutant when they mix with manually they more exposed to the pollutant which lead to respiratory problems depends upon the amount of dust inhaled, the percentage of free or combined silica in the dust, the size of the dust particles and the length of exposure. That inhaled dust deposited in the bronchioles and alveoli reacts within the lung tissue o form silicotic nodules. The nodule appears on chest radiograms as discrete rounded opacities. These nodules coalesce and form a continuous mass of fibrotic tissue called progressive massive fibrosis [17].

Accelerated and acute silicosis develop after short exposures to 'RESPIRABLE' silica dust at high concentrations. Accelerated silicosis differs from simple silicosis mainly in the time from first exposure to silica dust until silicotic nodules appear on chest radiogram. In accelerates silicosis the exposure varies from 5-15 years, the progression of the disease development is faster. Acute silicosis also termed silicoproteinosis develops after 1 to 3 years of exposure and progresses even faster. The present study was under taken to evaluate the effect of flourmill dust on worker with the period of 1-10years, 11 - 15 years and above 15 years compared with the clinically normal persons. This study also extended to construction workers with the period of 1-5 years and 6-10years labourers particularly participating in mixing of cement and sand manually. The pulmonary function tests parameters FVC, FEV1, PEF and PIF data was recorded utilizing SPIROWIN.

In flourmill workers FVC values are suggesting that the changes in the forced expiratory volume is more in higher exposure group i.e. above 15 years as compared to normal and the changes are significantly decreasing based on the period of exposure it lead to chronic bronchitis. Apart from respiratory symptoms due to local inflammatory changes caused by dust particles, they may become hazardous with respiratory sensitizing properties and may provoke asthma in individuals with pre-existing disease and also cause chronic bronchitis [18]. It also causes clinical manifestations including allergic and baker's asthma, wheezing, febrile reactions, grain fever, lung fibrosis, rhinitis, conjunctivitis, allergic alveolitis, impairment of lung function and chronic obstructive pulmonary disease [19]. These changes are in accordance with Sultan.A.Meo. [20] Who did a similar work in Korangi Industrial Zone, Karachi, Pakistan; he got

a decline of 31.56% in long exposure subjects as compared to a decline of about 10.78% in short term exposure. The changes in the long duration exposure is highly significant and same statements are coincide by Ramesh Bhat et al. [21], and S.K.Singh et al. [22]. Same as the FEV1 values are also decreased when these 3 groups compared with control groups the values are decreased along with the period of exposure. Above 15 years exposure workers are more prone than 1-10 and 10-15 years experienced persons. Similarly the above recoding suggest that the change in PEF and PIF values are more in higher exposure group i.e. above 15 years as compared to the short term exposure. In the wheat dust the Corzo and Naveda (1998) also observed decrease PFR, FEV, PEF values and positive correlation with the time of exposure when compared with anthropometrically matched subjects [23].

The present study results for FVC, FEV1, and PEF confirm the results observed by Ige and Awoyemi. (2002) [24] and Zodpey and tiwari (1998) [25]. Post et al. (1998) [26] showed an annual decline in FEV and maximum mid expiratory flow (MMEF), these parameters were significantly related to occupational exposure to dust in grain processing and in the animal feed industry. In addition, Bhat and Ramaswamy (1991) [21] demonstrated that FVC, FEV1 and PEF were significantly reduced in rice mill workers compared to controls. Similarly yach et al. (1985) [27] and chen (1992) [28] also compared the lung function tests in flourmill worker with controls. They founded that long time exposure to heavy concentrations of grain dust leads to impaired pulmonary functions. In non-smokers flour processing bakery workers are also having impaired pulmonary functions than controls (shamssain 1995) [29]. Schwartz et al. [30] and Zuskin et al. [31] also suggested from their study that the workers employed in the processing of flour may be at a risk for the development of respiratory impairment.

The present study confirms the findings of others and suggests that flour dusts adversely affects lung function parameter, such as FVC FEV1 PEF and PIF causes an obstructive pattern of lung function impairment which is associated with the dose effective of year of exposure to flour dust. The findings are of importance in that they demonstrate the extensive need for preventive measure and show the magnitude of the effect in a survivor population. It is advisable therefore, that flour mill managers, their workers and health officials should work together to adopt technical preventive measures, such as having well ventilated work areas and wearing appropriate respiratory protective devices. These measures will help to prevent lung damage, which often, overtime, contributes to morbidity and mortality. It is also suggested that flour workers must undergo pre-employment and periodic medical surveillance tests. It will helps for identify suspected workers and preventive measures as well as medication.

The study was also extended to the effect of exposure to the sand and cement in construction workers. The exposed for duration 1-5 years and 6-10 years obtained are the similar to the flour mill workers. The long termed (6-10years) exposed further decreased as the compared to short termed (1-5years) exposure. Similarly FEV1 in the short term group and long term group values are compared with clinically normal group is very low and statistically highly significant. The percentage difference of decrease of PEFR is very high as compared to the decrease of FVC and FEV1. PEF which is dependent upon airflow velocity is characterized by airway resistance. The exposures are capable of causing more bronchial inflammatory and anaphylactic changes resulting in bronchial obstruction decreasing in the velocity of airflow. These changes are expected to cause severe decrease in the FEV as in bronchial asthma. But in the pollutant exposure subjects the decrease in FEV1 is not that severe because there is a decrease of FVC also to a substantial extent suggesting the parenchymatous changes occurring in these individuals. The underlying mechanism of air way obstruction in flour mill workers may be due to the formation of specific IgE leading to immunological reactions which can be immediate, late or dual or materials being employed cause a direct liberation of broncho constrictor substances [19]. PIF rate in the short term exposure and long term exposure as compared with clinically normal subjects, decreased PIF and statistically highly significant.

Same above reason can be same i.e. decreased in the flow velocities caused due to bronchial changes. The changes in the construction workers were not compared statistically with the mill exposure group, but the decline in the first group is more as compared with the second. The decreased nutritional status may affect pulmonary function tests, but weights of both the groups are almost same. It can be suggested that people participating in the construction work are less organized and may be subjected for long hours of work increasing exposure duration. It is also possible that people particularly working in mixing process of cement and sand are much nearer to the pollutants causing more severe respiratory changes.

CONCLUSION

Exposure to pollutants like flourmill, cement and silica in construction workers cause severe respiratory disorders. Parameters like FVC and FEV1 which are more dependent on volume and capacities are no doubt reduced but to a lesser extent. Values of PEFR and PIF, which are more dependent upon the airways, are very much reduced, because the effects of the pollutants are more on bronchial tree. In almost of a similar duration of exposure construction workers suffer more from obstructive disorders of the lungs. The duration of exposure in both cases is directly related to the extent of damage. The study suggests that environment pollution can be detrimental and is directly related to the period of exposure. Measures like rehabilitation preventing the long-term exposure or minimizing the concentration of pollutants by various means are absolutely necessary for the prevention of COPD.

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