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Assessment Of Respiratory Health In Flour Mill Workers.

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ABSTRACT

Flour mill workers are exposed to variety of organic dusts, generated during the grinding process, making them susceptible to respiratory illness. We therefore assessed the respiratory health of flour mill workers by clinical, radiological, and functional methods. Total 100 flour mill workers with minimum work exposure of 4 years were enrolled in this cross sectional study. Their worksite was inspected for dust density and surroundings. A study specific validated questionnaire was used to assess the history, symptomatology and quality of life. The respiratory health was assessed by clinical examination, Chest X-ray and high resolution CT scan of thorax. Lung function was assessed using six minute walk test and spirometry. 10/100 had pre-existing Asthma/ COPD and they were using inhalers.54/100 subjects had frequent cough and 24/100 had exertional dyspnea. Spirometry revealed airway obstruction in 20 participants (12 reversible and 8 irreversible), CT scan showed Interstitial Lung disease in 6 participants (4 UIP and 2 NSIP pattern). 4/6 ILD desaturated on 6 minute walk test. Flour mill workers are at an increased risk of respiratory illness even after adjusting for genetic and environmental factors.

Keywords: flourmill, spirometry, occupational lung disease

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INTRODUCTION

Work place is an important part of an individual's environment. The physical health and efficiency of the workers working in the industries get influenced by the physical, chemical and social agents present in and around the workplace. As far as lung health is considered, variety of organic and inorganic dusts as well as noxious gases inhaled in the work environment can have long standing damaging effects on the lungs. Flour dust has been defined as an organic dust and is combination of particles of a variety of cereals grinded by milling. [1] It also contains contaminants such as silica, aflatoxin, insects, herbicides, etc.[2] The bacterial endotoxins have been shown to cause immunological effects both in vivo and in vitro [3] and this in turn may cause exacerbation of the respiratory condition of people with pre-existing airway diseases. Exposure to such dusts occurs in a wide variety of industries including grinding mills. The exposure level to the contaminants is at its maximum at the packaging sites of these mills. [4]

Spirometry and body plethysmography are the most widely used diagnostic tools to assess occupational lung diseases and useful to determine the functional impairments in terms of obstruction and restriction. Static and dynamic properties of the lungs can also be measured using body plethysmography.[5]There are few studies that have assessed the lung effects of the flour dust on humans[6]. A threshold density limit of 0.5 mg/m^3 of flour dust has been determined as the minimum exposure level to cause respiratory illness. [7]

There are many pathophysiological mechanisms by which flour dust can affect the lungs. It can act as an irritant and can cause short term upper respiratory, eye and lower respiratory symptoms. Irritation of hyper-reactive airway can trigger underlying asthma. Many studies have documented flour and grain dust as common triggers associated with occupational asthma.[8] On the other hand, due to its very nature, organic dusts can trigger a type I hypersensitivity immune response on repeated exposure and cause asthma. The respiratory effects of flour dust depends on the dose and duration of exposure to these irritant or the sensitizing agents.[9] These workers get exposed to flour dust for average 8 hours a day and are at potentially high risk of the adverse respiratory effects.

This study was designed to evaluate the respiratory health of grain mill workers who were exposed to flour dust for at least 4 years. They were evaluated for clinical symptoms, structural impact on lungs due to dust deposition and also for functional disability.

MATERIALS AND METHODS

This was a cross sectional observational study carried out in a suburban area of Pune city. Institute Ethics Committee clearance was obtained before the start of study. A total of 100 flour mill workers were evaluated after obtaining their written and informed consent. Only the workers above the age of 18 years and with minimum work exposure of 4 years with average 8 hours a day work shift were enrolled. Those with contraindications to Spirometry and those with active transmissible respiratory infection such as Tuberculosis were excluded.

The initial evaluation including history and health questionnaire assessment was done on the work site. The work site was also inspected for dust density, ventilation, presence of pigeons and wall fungus (potential allergens). The enrolled persons were called to the study site for further evaluation that included Spirometry, X-ray chest and six minute walk test with SpO2 monitoring. High resolution CT scan (HRCT) thorax was done for those with interstitial shadows or abnormal findings on Chest radiography.

RESULTS

In this study, workers form all age groups between 18 to 80 years were included. 54 of the participants were males and 46 of them were females. As regards the nutritional status, 47% had normal BMI, 36% had high BMI, 12% were obese and 5% had low BMI. 49% of the subjects were working for more than 10 years (figure 1), 95% participants were non smokers and 5% were current or ex-smokers.

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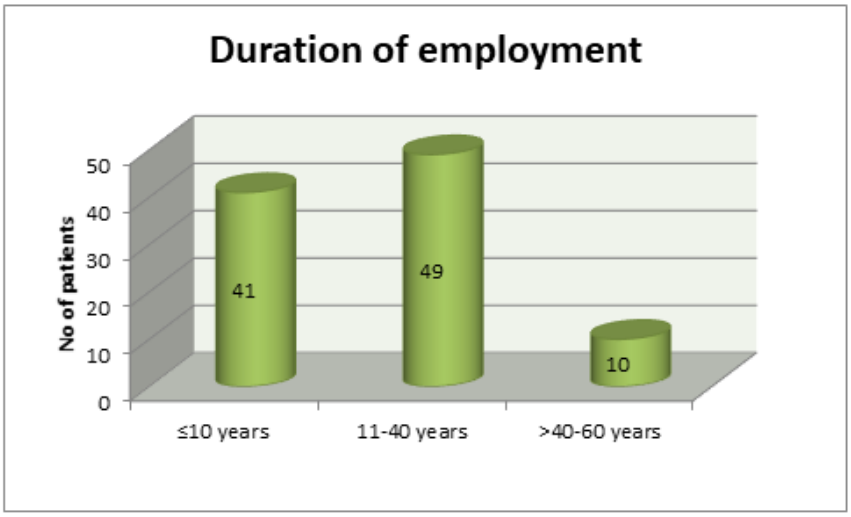
58% participants had normal Chest X ray, 14% had hyperinflation suggesting air trapping, 22% X rays showed increased bronchovascular marking and 6% X rays revealed reticulonodular shadows suggesting dust-lung disease.

On HRCT evaluation, 47% had normal CT scan findings, 4% scans showed mosaic pattern suggesting air trapping, 5 scans showed emphysematous bullae, ground glass opacities were noticed in 10% scans whereas there was overt lung fibrosis with honeycombing in 4% (figure 2) and in 30% CT was not done as they were normal clinically and functionally and had a normal chest X ray. Among the 100 participants, 10/100 had pre-existing Asthma/ COPD and they were using inhalers. 54/100 subjects had frequent cough and 24/100 had exertional dyspnea (table 1). Spirometry revealed airway obstruction in 20 participants (12 reversible and 8 irreversible) (figure 3), CT scan showed Interstitial Lung disease in 6 participants (4 UIP and 2 NSIP pattern). 4/6 ILD desaturated on 6 minute walk test. Out of 100 subjects enrolled in the study, 47 had normal respiratory health, whereas 12 had occupational bronchial asthma, 8 had occupational COPD, 6 had occupational ILD, 3 had pre existing COPD, 3 had pre existing bronchial asthma and 4 had pre existing chronic bronchitis (figure 4)

Figure 1: Duration of employment in the flour mill



Respiratory Symptoms	No of subjects
Wheeze	15
Cough	54
Dyspnea	29
None	46
Total	144*

Table 1: Respiratory Symptoms

*Total number of symptoms is higher than the sample size as some of the subjects had two or more than two symptoms.

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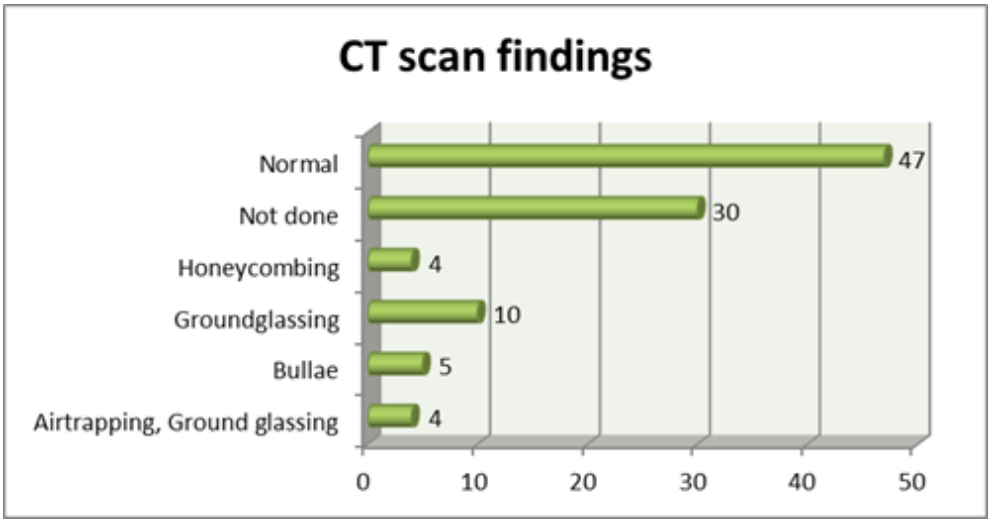

Figure 2: CT Thorax findings

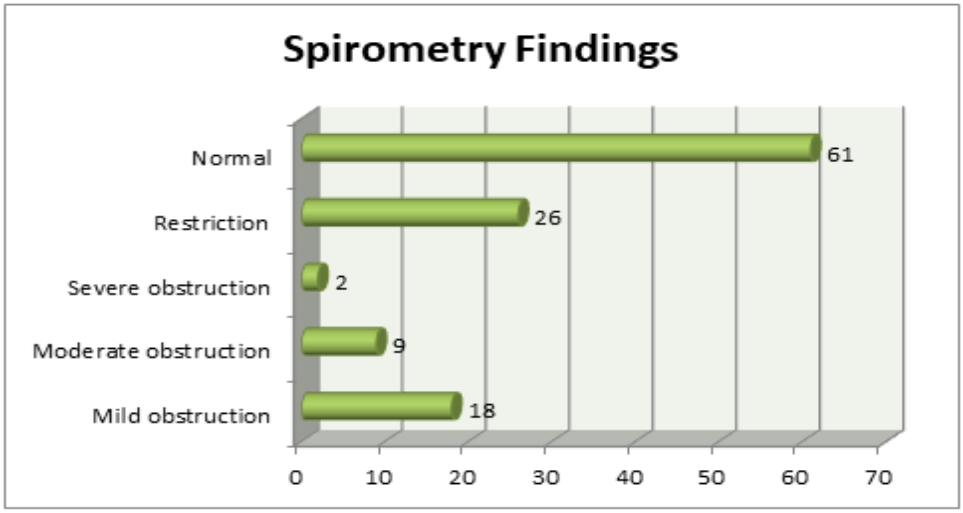

Figure 3: Spirometry findings

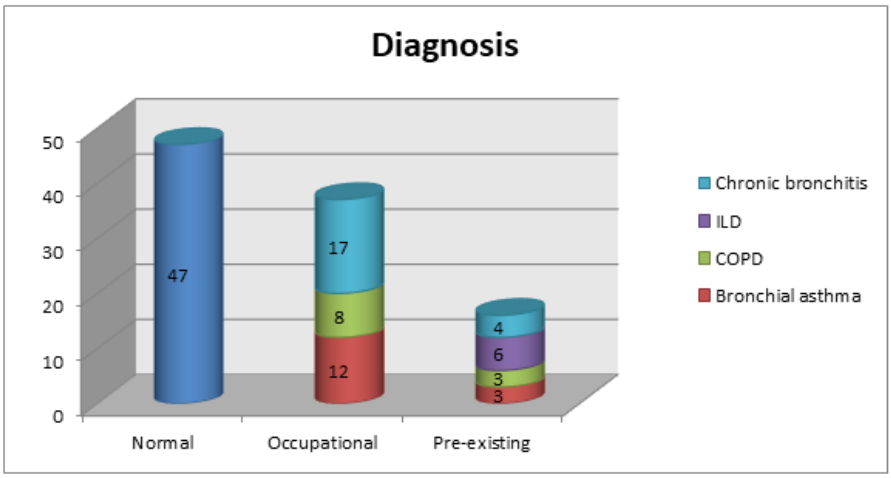

Figure 4: Respiratory diagnosis of the participants enrolled in the study

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DISCUSSION

The study was on field and hospital based study that was Department of Respiratory Medicine in a tertiary care hospital, Pune, Maharashtra. The study aimed to assess the respiratory clinical, radiological and functional respiratory health status of flour mill workers. Flour dust refers to dust coming from finely milled or otherwise processed cereals and pulses. Hypersensitivity reactions as well as airway irritation caused by flour dust constitute a well-recognized occupational problem world-wide. Flour dust has been considered as a major health hazard but not been discussed in detail amongst occupational lung diseases. As expected, this study has proved our hypothesis that it will result in chronic airway and parenchymal abnormalities. Hence education regarding occupational health is mandatory amongst laborers working in flourmills.

There were 54 Males and 46 Females in the study. All the participants enrolled in this study were more than 20 years of age. Amongst these participants, almost 30 patients had comorbidities, whereas only 5 of them were smokers. In this study, 2 of the participants had preexisting COPD, 20 were diabetic, 11 were hypertensive and 1 had ischemic heart disease and all of them were on treatment. Amongst them, 47 had normal BMI, 7 had low BMI, 36 had high BMI, 12 were obese. However, BMI did not have any correlation with the respiratory health status. Among the individuals enrolled in the study, 49% of them had worked in the industry for more than 10 years, which also increases the precision and credibility of this study.

Among these participants, 54% of them had frequent respiratory symptoms like cough, dyspnea, wheeze. Among them, 27 had cough which was present throughout the day and 5 days a week, whereas only 12 of them had persistent dyspnea and 15 had wheeze.

55% of the individuals who had cough had taken symptomatic treatment on and off by general physicians, but weren't investigated thoroughly. It was also observed that people with asthma had symptoms during workdays and were symptom free during holidays.

There was a study conducted by Mohammadien et al. [10] which was conducted in 200 flour mill workers for a 2 year period and found that the respiratory symptoms like breathlessness, productive cough and wheeze is more in the flour mill workers than the control, these data was obtained by the questionnaire on work history, smoking history and respiratory symptoms. Similarly in this current study, on examination, 70% of them had normal auscultatory findings, whereas 30% of them had rhonchi or crepitations on auscultation. Chest X ray was done in all these participants which revealed abnormalities like hyperinflation, increased bronchovascular marking and reticulonodular shadows in 42 of them, whereas 58 had normal findings. CT chest was done only in 70 of these participants, in the remaining 30 CT was not done since they had a normal chest X ray and spirometry. Amongst these 70 who got their CT chest done, 47 had normal findings and 23 had abnormalities such as mosaic pattern, ground glass opacities, honey combing and bullae.

All these participants were assessed functionally by six minute walk test and spirometry with bronchodilator reversibility. In spirometry, 61 had normal study. Among the remaining participants, 19 had obstruction, 26 had restriction whereas 16 had both obstruction and restriction. Amongst the 100 participants, 4 desaturated while doing the six minute walk test.

From the above mentioned data, 47 of these participants had a normal clinical, radiological and functional status even after had worked in the flour mill for more than 4 years, whereas 17 had developed chronic bronchitis, 12 had developed bronchial asthma, 8 had developed COPD and 6 had developed ILD. Also, 4 of them had preexisting chronic bronchitis, 3 had preexisting bronchial asthma and 3 had preexisting COPD. The above data confirms reduction in the pulmonary function and efficiency among the flour mill workers. In this study, 70% of the subjects were not using any protective equipments while working in the flour mill. Exposure to occupational dusts plays a major role in the development of COPD for many individuals. From the above analysis, 53 participants had abnormal respiratory health, amongst which 10 were already affected and were on treatment at the time of enrollment in this study, whereas the remaining 43 were newly diagnosed.

Diseased individuals were given treatment and counselled to abstain from their work place, others were counselled about personal protective measures as majority were not using any protective equipments as they were unaware about the ill effects of flour dust. While conducting this study and on investigation of the work place area, it was observed that these workers are working in small spaces in the flour mill throughout

the day. The floor space varied between 100 sq. feet to 400 sq. feet. These workers stand very close to the grinding machines while working. Hence, these individuals are exposed continuously on a daily basis to a very high concentration of the flour dust. It was also observed that no exhaust system was observed in 25 out of the 32 flour mills visited.

In this study, it was also observed that 70% of the subjects who had impairment in the lung function had longer duration of exposure in the flour mill. More duration of exposure, causes increased accumulation of higher doses of dust in the lower airways and cause ventilation impairment and respiratory ailment in the individuals.

Cheryl Ann Melo et al [11]also mention that flour dust causes significant decrease in lung function parameters such as FEV1, FVC, FVC%, and FEV1/FVC. It can cause both obstructive as well as restrictive pattern of lung function impairment. Post bronchodilator testing had showed that 83.33% of the 15% had obstructive abnormality with reversible airway obstruction and 16.67% had irreversible airway obstruction.

The innate immune mechanism and structural integrity of the airways protect the normal individuals from the destructive effects of the flour dust. The mucociliary escalator and alveolar macrophages are involved in the clearance. But heavy exposure of these dusts may result in damage of the macrophages and mucociliary escalator and can cause damage to the interstitium.

The dust particles that are deposited on the airways, are cleared by the mucociliary escalator and macrophages, but such clearance may be affected if these mechanisms are damaged by smoking or inhalation of fumes. Hypersensitivity pneumonitis was initially recognized by Bernardino Ramazzini in wheat reapers in 1713, is an interstitial lung disease caused by an immune response to an inhaled antigen.

CONCLUSION

In a country like India, where there are a number of flour mills, it is mandatory for the health care professionals and the common people to understand the hazardous effects of the flour dust and the preventive measures to protect from such hazardous health effects. But unfortunately in our country mortality due to occupational health hazard are reported to be high. But it is not the same case in developed countries, where proper precautions and preventive safety measures are followed. While conducting this study, it was evident that these flour mill workers were not following any safety standards and preventive protocol which had resulted in multiple airway and parenchymal abnormalities.

Most of these workers are not aware of the hazardous effects of the exposure to the flour dust. Unhealthy working environmental conditions like small work area, not using protective measures like mask were observed in the flour mills during the study. These conditions had adverse health effects on the workers. An increased reduction in the lung function is found in the individuals with a longer duration of exposure to the flour dust.

We conclude from this study that these workers in flour mill are at an increased risk of developing airway and respiratory parenchymal abnormalities. Hence it is mandatory that these workers need to be educated regarding the health effects of the flour dust, and should be advised to use personal protective measures like masks. Also changes has to be made in the ventilation and engineering of the flour mill work space. These should also be encouraged to undergo periodic health examinations and consider abstinence from work place in case of respiratory symptoms.

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