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Assessment of Respiratory Stress in Work Place Environment of Sugar Industry

KEYWORDS: Forced vital capacity, Total lung capacity, Forced expiratory volume in one second, occupational hazards.

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ABSTRACT *The sugar industry constitutes one of the biggest industry in Maharashtra. There is labour intensive employment of about thousands of workman. It is the largest agro based industry plays a Key role in economy of Maharashtra state. The working and living conditions of the sugar industry workers are extremely poor. The occupational health problems in workers working in various processing units of sugar industry are enormous , mainly because of variety of occupational stress factors. High concentration of clay dust in cane yard section , bagasse dust in mill and bagasse baling section are the main causes of respiratory problems among these workers. In present investigation lung function tests viz. TLC, FVC and FEV1 from randomly selected ten workers from each processing unit (section) of engineering sectionof sugar industry during work were investigated. The workers from general office were taken as control group. It was found that, the values of TLC, FVC and FEV1 were significantly lower in workers working in cane yard section, mill section and bagasse baling section as compared to those of control subject.*

Introduction

India is the second largest in the world as for as sugar production is concern next to Brazil.Sugar industryconstitutes one of the largest sector in our country employing over 0.5million skilled and unskilled workman mostly from rural areas. The sugar factory is one of the highest paid in country. Assesment of many sugar factories indicated that the workers are exposed to high concentration of dust, excessive heat, high intensity noise that affects the health of the worker.

Respiratory ailments associated with work place havebeen reported by various authors (Jiirvinen et al. 1979, Rylander et al. 1986, Popp W. et al. 1989,Zskin E.et al . 1992 , Pundit et al. 1994 and Singh A. et al. 1998). Rahman et al. in 2001 reported that the most important of the respiratory diseases known to have major environmental risk factors include pneumonia, chronic obstructive lung disease, TB, asthma, lung cancer and various other occupational lung diseases.

The workers working in the sugar industry are prone to face a number of stresses. Sugar mill employees would develop flulike symptoms several hours after reporting to work at the beginning of a new season or even after a free week end, repeated attacks causes fine scarring of the lungs and impaired breathing. "The chest X-rays often resembled military tuberculosis. It's all gone now you never see it" says Dr. JohnBobear, a Louisiana state University school of Medicine Faculty member. It is also known that an allergic reaction also occurs after exposure to the spores on sugarcane. Spraying with propionic acid can kill the sugarcane spores it is known that, bagasse is the culture media for mold and inhalation of the mold causes hypersensitivity reaction in the lungs.Bagassosis is an occupational lung disease of the extrinsic allergic alveolitis type, caused by breathing dust containing spores of thermophilicactinomycetes which grow in stored mouldy bagasse. Hypersensitivity pneumonitis can also result from this exposure (Biggins et al.,1991 and Munoz et al., 1992).A fungus is probably responsible for bagassosis caused by bagasse dust in young and middle aged men who work in the sugar industry (David 1999).

MATERIAL AND METHODS

Study area:

The present study was carried out in Hutatma sugar industry at walwa having 4500 tons of crushing capacity per 24 hours.Walwais the tahasil place in Sangali district, Maharashtra.

Subject

The process of sugarcane refining is carried out in two main steps in various processing units or sections. In first step pressing of sugarcane and extraction of juice is completed in engineering section,in second step crystalline sugar is manufactured in manufacturing section of sugar industry. For the present study randomly selected ten workers from various sub department of engineering section were selected. The workers from office section were taken as control group. A detailedquestionnaire for socio-economic and health information was filled up with due consent from those who volunteered for the study as most of the workers had poor educational background.

Methods

The sampling of the dust was done by High Volume Sampler. The amount of respiralable suspended particulate matter is observed directly with sampler. The anthropometric measurement (Standing height and weight etc.) was recorded .The spirometric functions were recorded in the sitting position using spirometer. The pulmonary function viz. TLC, FVC and FEV_1 were recorded with the help of spirometer. Each individual performed spirometry thrice to produce the best result.

RESULT AND DISCUSSION:

Assesment of many sugar industries indicated poor sanitary provisions and lack of safety equipment. The workers working in sugar industry have to perform various types of tasks in various sections of the sugar industryand are exposed to adverse environment.

Table: 1. Dust concentration in sugar industry environment engineering section

Name Of section	SPM (µg/Nm3)	RSPM (µg/Nm3)
Cane yard	635	192
Mill	452	155
Boiler	455	150
Bagasse baling	1275	465
Power turbine	93	30

Table 1 indicates dust concentration in sugar industry environment engineering section. The higher concentration of

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dust found at cane yard, mill, boiler and bagasse baling section. It was significantly high 1275 µg/Nm^3 suspended particulate matter and 465 µg/Nm^3 respirable particulate matter at bagasse baling section.

Table :2. Anthropometric measurement of workers in various sub sections of engineering section of sugar industry

Section	Age(yrs)	Height(Cm)	Weight(Kg)	Employment time(Months)
General Office	42.4±6.687	159.4±5.542	58.9±11.030	138.8±19.668
Cane-yard	45.3±6.183	161.2±7.058	58.2±11.013	153.1±22.063
Mill	42.6±7.121	165.1±3.446	64.0±7.024	146.9±19.128
Boiler	43.4±5.835	161.7±4.029	59.6±10.373	157.9±29.790
Bagasse Baling	40.8±7.330	162.8±4.131	60.1±11.100	156.6±27.758
Power Turbine	41.2±5.391	162.9±3.665	56.6±5.232	157±27.649

Values are mean±S.D.

Table 2 indicates anthropometric measurement of workers in engineering section of sugar industry .The workers are middle aged,the age ranges from 30 to 58 years.Furthermore, usually workers render long period of service ranging from12 years to as long as 36 years.

Table: 3. Mean value and standard derivation of lung function test parameters in worker of engineering section in sugar industry.

Section	TLC L/min	FVC L/min	FEV_1 L/min
General Office	3.210±0.220	1.490±0.240	1.170±0.160
Cane-yard	3.116±0.51	1.264±0.140	0.999±0.18
Mill	2.895±0.35	1.309±0.190	1.061±0.20
Boiler	3.075±0.29	1.427±0.31	1.017±0.24
Bagasse Baling	2.746±0.31	1.309±0.15	0.813±0.20
Power Turbine	2.990±0.32	1.454±0.17	1.121±0.14

Table 3.indicates mean value & standard derivation of pulmonary function test parameters in worker of engineering section in sugar industry. The values of TLC,FVC and FEV_1 from all the sections of sugar industry are found to be decreased as compare to the control group. The significant decrease was found in workers working in bagasse baling section.

In present investigation it was found that the FEV_1 values of workers working in cane yard and bagasse baling, section were significantly decreased which indicate acute pulmonary impairment. The presence of high concentration of clay dust in cane yard section and bagasse dust in bagasse baling section, may be a significant source for ventilatory impairment.

Hypersensitivity pneumonitis is granulomatous interstitial lung disorder resulting from reaction to allergensin a predisposed host occupationally it occurs in susceptible workers. It was first described by Ramanzzini in 1713 with the symptoms of cough and shortness of breath in workers exposed to dusts of cereal grains. Compbell first described farmers lung in 1932 which was further defined by Dickie and Rankin in 1958 as an acute granulomatous interstitial pneumonia caused by exposure to mouldy hay. Brobson (2001) has reported that about 250 substances in workplace can cause occupational respiratory disorders and the list of causative chemicals, enzymes animal proteins and plant allergens is growing.

Anand et al. (1999) surveyed 200 workers from the sugar refinery and reported that 10% of the workers suffered from breathlessness 80% of them had wheeze. Its incidence was invariant with age and duration of the employment of subject.

There is decrease in FEV_1 in patients with hypersensitivity pneumonitis (Donald, 1997). Sawant and Dubal in 1995 reported that there is decrease in FEV_1 values among the workers exposed to cotton dust. Byssinosis and bronchitis cause fall in FEV_1 (Fox et al. 1973). A steep fall in FEV_1on the first working day after a weekly off is brought to indicate susceptibility to the development of Byssinosis(Fox et al. 1976). The FEV_1values are significantly lowered in foundry workers exposed to silica dust (More, 2003).

The forced expiratory volume in one second is significantly lowered in workers working in sugar refinery and chalk powder workers (Bohadana et al. 1996).FEV_1 is the most powerful predictor of mortality in patients with chronic obstructive pulmonary disease (Traver et al. 1979). There is decrease in FEV_1in patients with chronic obstructive pulmonary disease (Celli R. 2000). The forced expiratory volume in one second is very sensitive to the presence of air flow limitations (Imad et al. 2003).

It is also known that in classic allergic occupational asthma a specifically inhaled substance from the workplace sensitizes the workers airways. Later exposure to the same vapour, dust or fumes can cause coughing wheezing or difficulty in breathing.

In sugar industry respiratory illness was found particularly more severe among the workers working in bagasse baling section. Workers showed complex symptoms associated with cough, fever, chest tightness and wheezing. Incidence of respiratory illness shows relationship with duration of exposure to bagasse dust, the severity of illness was found to be increased with age. Most of the workers from bagasse baling section were smoker and alcoholic.Thus the improvement of occupational environment is necessary for the maintenance of the health status of workers and for creation of the environment for productive and qualitative labour.

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