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Pulmonary Function Tests in Workers Exposed to Sugar Industrywork Place

KEYWORDS: Occupational stresses, Sugar industry workers, Pulmonary function test.

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ABSTRACT *In Maharashtra sugar industry is the largest agrobased industry,plays a key role in economy and provides employment to many peoples from rural areas.The work place of sugar industry is characterized by many stress factors such as high intensity noise, excessive heat, high concentration of dust, toxic fumes of gases and chemicals. The health of the worker is affected by adverse working environment.In present investigation pulmonary function test parametersof randomly selected ten workers from manufacturing section of sugar industry were studied. The workers from general office were taken as control group. It was found that the values of TV, IRV,ERV,IC and VC were at low level as compare to control office workers*

INTRODUCTION

India is the second largest country in the world as for as sugar production is concern next to Brazil, employing over 0.5million skilled and unskilled workman mostly from rural areas. In Maharashtra state 25lakhs of farmers grow sugar cane. It gives direct employment to about 7.5 lakhs of workers.the sugar factory is one of the highest paid in country.

Various studies on health and safety in agriculture have revealed health problems and disease patterns in Agriculture. Most of the studies in this area have indicated a high risk for particular cancers, respiratory diseases and injuries to the agricultural workers. Several natural products have been associated with occupational asthma when processed, these include vegetable gums, flax seed, castor bean soyabean, coffee bean, grain products, flour, orris root, papain and tobacco dust (Merchant et al.1988).Swan and Crook 1998 have reported of substantial evidence that workers handling grain dust develop respiratory symptoms. Probably between 5% and 15% of all persons who are regularly exposed to organic materials develop hypersensitivity pneumonitis (David 1999). Hypersensitivity pneumonitis (HP) is a group of lung diseases caused by inhalation of a wide variety of materials that usually are organic and always are antigenic (Mark Schuyler 2002). .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 of sugarcane. Spraying with propionic acid can kill the sugarcane spores.

The Laboratory of physiology, Department of Zoology, Shivaji University, Kolhapur (India) is engaged in extensive work in toxicology, occupational physiology and some applied problems in textile, foundry and sugar industry.In many jobs, the workers were exposed to various types of health hazards and environmental stress factors.

Sawant and Muthane (1988) described the assessment of workload and respiratory stresses in textile industry at Ichalkaranji. The environmental conditions and respiratory stresses among workers in the powerloom sector worked out by sawant and Dubal (1995b). While working conditions and health status of workers in various processing units of Ichalkaranji was carried out by Sawant et al. (1995).Health risks in the spinning mill workers were studied by Sawant et al. (1999). The effect of cotton dust and or associated endotoxin (s) on platelet count of rat were studied by Sanandam et al. (2000).Cotton dust induced Neutrophilia in powerloom workers at Ichalkaranji were studied by Sawant et al. (2000). Physiologicalreactions to cotton dust animal model was developed by Sawant et al. (2001). Effect ofrespirable textile particulate matter on animal model rat were observed by Sawant et al. (2001). Physiological reactions to cotton dust exposure development of an animal model has been worked out by Dubal (2002). Air borne pollutants and respiratory impairment in textile environment has been studied by Sanandam et al. (2002). Physiological studies of rats exposed to cotton dust has been studied by Sanandam (2002). In sugar industry although human factor is very important factor which plays very important role in productivity it is often being neglected.

For sugar cane the process of refining istwo step procedure completed in various processing units in first step the sugar cane is pressed to extract the juice in engineering section and in second step crystalline sugar is manufactured in manufacturing section. The present study is carried in manufacturing section which includes juice, pan, centrifugal, sugar house and godown section.

MATERIAL AND METHODS

Study area

The present study was carried out in PadambhushanDr.Naganath Anna NayakawadiHutatmaKisanAhirSahakariSakharKarkhana,Walwa.Dist.Sangli.having 4500 tons of crushing capacity per 24 hours.Nationally renowned for the recovery of sugar. The industry provides employment to 324 permanent workers.

Subjects:

Randomly selected ten workers from various subunits of manufacturing section of sugar industry were studied for the respiratory stress. 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.

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Methods

The sampling of the dust was done by High Volume Sampler. The amount of respirable suspended particulate matter is observed directly with sampler. The sampling of sulphur dioxide was done by sodium Tetrachloromercurate Method .The anthropometric measurement (Standing height and weight etc.) was recorded. The spirometric functions were recorded in the sitting position using spirometer. The lung volumes like Tidal volume(TV), Inspiratory reverse Volume(IRV) and Lung capacities like vital capacity (VC), Inspiratory capacity (IC) were recorded with the help of spirometer. Each individual performed spirometry thrice to produce the best result. The room temperature was maintained between 34^{0}C -36 ^{0}C.The present study is conducted on workers during the operational period of sugar factory. To evaluate the effect of occupational exposure, the workers were divided into three categories i.e. those exposed for 8-10 yrs, 10-15 yrs, and ≥15yrs to the dust and fumes.

RESULT AND DISCUSSION

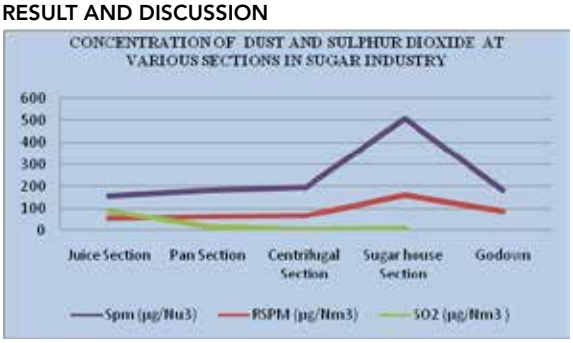

FIG1

Fig 1 indicates concentration of dust and sulphur dioxide at various sections of sugar industry.It was found that the higher concentration of suspended particulate matter 508µg/Nm3 and respirable particulate matter 160 µg/Nm3 at sugar house section.The concentration of sulphur dioxide is higher at juice section near sulphurfurnace(87.17µg/Nm3)

Table :2. Anthropometric measurement of workers in manufacturing section of sugar industry

Section	Age(yrs)	Height(Cm)	Weight(Kg)
General Office	39.8±5.808	159.4±5.542	58.9±11.030
Juice Section	39.8± 6.11	163.5± 56.3	57.7± 8.17
Pan Section	40.20± 7.37	164.1± 4.23	63.1± 7.11
Centrifugal Section	42.2± 6.76	164.3± 5.47	60.9± 6.57
Sugar House Section	36.9± 9.53	164± 5.06	68.4± 12.10
Godown Section	37.5± 8.19	165.9± 5.39	65.7± 6.03

Table 2 indicates Anthropometric measurement of workers in manufacturing section of sugar industry . The workers are mostly middle aged, the age ranges from 36 to42 years. Furthermore, usually workers render long period of service ranging from8 years to as long as 22 years.

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

Section	TV L/min	IRV L/min	ERV L/min	IC L/min	VC L/min
General Office	0.738±0.240	0.986±0.380	0.570±0.150	1.663±0.320	2.187±0.300
Juice Section	0.532±0.11	0.658±0.09	0.500±0.14	1.180±0.1	1.677±0.21
Pan Section	0.525±0.14	0.952±0.31	0.417±0.18	1.477±0.36	1.894±0.34
Centrifugal Section	0.591±0.13	0.822±0.29	0.344±0.18	1.393±0.22	1.737±0.26
Sugar House Section	0.523±0.13	0.760±0.15	0.465±0.12	1.283±0.19	1.754±0.23
Godown	0.701±0.27	0.837±0.21	0.415±0.17	1.539±0.32	1.955±0.41

Table 3 indicates mean value and standard derivation of pulmonary function test parameters in workers of manufacturing section in sugar industry. All the values of TV, IRV, ERV, IC and VC are at low level as compared to control group. The significant decrease was found at juice section and sugar house section.

Table 4.: Mean value and standard derivation of pulmonary function test parameters in relation to duration of occupational exposure.

Age Group	TV	IRV	ERV	IC	VC
8-10 years(N=19)	0.675±0.151	0.927±0.255	0.483±0.184	1.602±0.259	2.085±0.267
10-15 years(N=17)	0.569±0.222	0.797±0.238	0.418±0.186	1.472±0.314	1.891±0.361
>=15 years(N=14)	0.558±0.161	0.737±0.171	0.427±0.165	1.26±0.181	1.698±0.272

Table 4 indicates mean value and standard derivation of pulmonary function test parameters in relation to duration of occupational exposure. It was found that all the values of TV,IRV,ERV,IC& VC are reduced with the increase in duration of occupational exposure .The significant reduction was found in group of workers exposed above 15 years in sugar industry work place environment.

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In the sugar industry manufacturing section workers working in adverse working condition. The health of the workers is mainly affected by working environment and working condition. In present study it was found that the workers from juice section and sugar house section are exposed to heat,noise , toxic fumes of sulphur dioxide from sulphurbhatti.and sugar dust. None of the workers were provided with masks to prevent the inhalation of sulphur dioxide. The tidal volume, inspiratory reserve volume, inspiratory capacities, vital capacities are found to be decreased in workers working in manufacturing section of sugar industry. The presence of fumes of sulphur dioxide in juice section and concentration of sugar dust in sugar house section may be the significant source for ventilatory impairment.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 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. In sugar industry respiratory illness was found particularly more severe among the workers working in juice and sugar house 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.

In present investigation it was observed that the high concentration of sulphur dioxide gas which is 87.17 µg/Nm3 near sulphur furnace. The workers working in juice section particularly in vicinity of sulphur furnace complain of eye and throat irritation, suffocation, cough etc.Increase in concentration of sulphur dioxide above permissible limits causes suffocation, irritation of throat and eye. repeated exposure to 10 ppm concentration of sulphur dioxide results into upper respiratory irritations (Federa1,1975).

Agarwal and Agarwal (1994) suggest that the exposure to dust produces pulmonary edema, bronchial asthma, pulmonary mycosis, bronchopulmonaryaspergillosis, rhinitis, sinusitis, otitis, irritability and inflammation of heart.In present investigation, it has been demonstrated that the concentration of respirable dust particles is significantly high sugar house section. These respirable dust particles easily reach the wall of alveoli and may cause inflammation leading to the respiratory impairments.

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