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STUDY OF EFFECT OF OCCUPATIONAL STRESS FACTORS ON PHYSICAL FITNESS SCORE OF SUGAR INDUSTRY WORKERS WORKING IN ENGINEERING WORK SECTION

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Abstract:

The sugar industry is one of the largest agrobased industry in India. India is the second largest producer of sugarcane next to Brazil. The workers are subjected to during their working lives to an environment that affect their physical and mental health. In present investigation randomly selected ten workers from various processing units or sections were assessed for their basic characteristics, exposure period, grip strength and physical fitness score. It was found that the adverse working environment affects the health of the sorkers which results to decease in physical fitness score of the workers.

KEYWORDS:

sugar industry worker, physical fitness, score occupational hazards, stress .

INTRODUCTION

The sugar industry is one of the largest agro based industry in India.It plays important role in national economy and provides employment to thousands of skilled and unskilled workers from rural areas. There are physical, chemical and biological agents in the working environment of sugar industry which may adverse to health of the worker. The working capacity of the workers is affected by physical agents such as noise, temperature, humidity, light etc. The chemical agents in working environment includes dusts, toxins, gases and fumes of chemicals which cause health hazards

Working conditions in sugar industry include cleanness, light, temperature (heat), ventilation, noise, vibration, physical energy required, length of the work day, irregularity of the work hours such as the night shifts or the rotation of shifts, physical hazards, exposure to possible industrial stressors and similar conditions that directly or indirectly influence the worker's happiness, satisfaction, dissatisfaction at work. Physical, mechanical as well as organizational environments constitute working conditions in an industrial or business establishment. which may adverse to health of the worker and working capacity of the worker.

The present study have been carried out to evaluate the physical fitness score of the workers exposed to physical stress factors such as excessive heat, noise,high concentration of dust. Efforts have been made to correlate the working environment and health problems of sugar industry workers by studying changes in physical fitness score and grip strength during work.

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

Studies on occupational stresses among the textile workers were carried out by Sawant and Muthane (1994). The physiological responses and occupational stresses among powerloom workers were studied by, Sawant and Dubal (1995a)The occupational health hazard among spinning mill workers in Ichalkaranji studied by Sawant and Kore (1995). While working conditions and health status of workers in

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various processing units of Ichalkaranji was carried out by Sawant et al (1995.)Assessment of occupational stresses using animal model were worked out by Sawant and Sanandam (2000).)Environmental stresses and their management were observed by Sawant and Shinde(2000).Physiological reactions to cotton dust an animal model was developed by Sawant et al.(2001)Physiological studies on foundry workers in relation to work and stress has been worked out by More (2003). Nayakawadi and Sawant reported on the assessment of environmental conditions and stresses in sugar industry and the physiological evaluation of jobs and occupational stresses in sugar industry (2001).

MATERIAL AND METHODS

Study area

The present study was carried out at Hutatma Co. sugar industry walwa,Dist.Sangli having 4500 tons of crushing capacity per 24 hours and employing 645 workers in all.

For sugar cane the process of refining is carried out in various processing units or sections by the following ways.

A) Cane-yard section: It involves unloading of sugarcane loaded vehicles.

B) Engineering section: It involves Pressing of sugarcane to extract the juice. It is completed in various sub sections as :

- i) Mill section- Cane cutting, crushing and fiberizing is completed in mill section.
- ii) Boiler section- Boiling of juice in series of four boilers.
- iii) Bagasse baling section- Bailing of shredded bagasse and its storage.
- iv) Power turbine section- Production of electricity which is required for the factory work.

C) Manufacturing section: It constitutes following sub sections:

- i) Juice section- It involves boiling the juice until it begins to thicken and sugar begins to crystallize and the clarification of juice by sulphatation
- ii) Pan section- Spinning the crystals in a centrifuge to remove the syrup, producing raw sugar.
- iii) Centrifugal section- Shipping the raw sugar to a refinery where it is washed and filtered to remove remaining non-sugar ingredients i.e molasses and color.
- iv) Sugar house section- Crystallizing, drying and packaging the refined sugar

D) Godown section –Lifting carrying and storage of sugar bags.

Subjects

The study of basic characteristics grip strength and physical fitness ten workers from cane yard and engineering sections viz. mill, boiler, bagasse baling and power turbine sections of sugar industry were selected randomly.

METHODS OF EVALUATION OF WORKERS

Physical fitness:

The physical fitness score of selected workers were carried out by step test in the following way:

Harvard Modified Step Test :

This test is used for evaluating the physical fitness of individual for selection of job. This step test was originally developed in the Harvard Fatigue Laboratory, U.S.A. It has been slightly modified so as to make it convenient for the short statured and aged persons

Grading of score is:

Below 50- Poor, 50 to 65 -Low average, 65 to 80- High average ,80 to 90-Good ,Above 90-Excellent All the workers were evaluated in uncontrolled laboratory condition in office room of sugar industry at Walwa

Grip Strength Study:

The Grip Dynamometer is an instrument used for assessment of grip strength of an individual. The same selected workers for physical fitness were studied for grip strength by Grip Dynamometer. The grip strength of right hand and left hand with vertical and horizontal position were recorded

The workers from office section were taken as control group. A detailed questionnaire 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.

RESULT AND DISCUSSION

DESCRIPTION OF JOB

The survey of all the sections of processing units of sugar industry reveals that the workers are exposed to adverse environment. In the process of sugarcane extraction of juice from sugarcane unloading of the sugarcane, extraction of juice and production of electricity was carried out in cane yard and engineering sections which include subsections mill, boiler, bagasse baling and power turbine. The common stress factors are noise, heat, vibration and high concentration of dust i.e. clay dust and bagasse dust. The workers working in 6 days per week and 8 hours per day.

In sugar industry starting from cane yard section up to the sugar house section noise and heat are the common stress factors and are increased or decreased in various sections.

The questionnaire survey revealed that most of the workers were illiterate, smoker, and drinker. Most of the workers complained about back pain, body ache, lower back pain, pains in shoulder and neck, throat infection, fever, cough is very common among all workers at the starting of seasonal work. Some workers also complained about pains in hand and legs weakness, eye irritations, head ache, acidity, suffocation. Workers who have to work at night and sleep by day will suffer two forms of stresses: stress in having to work during a period of deactivation, which will entail extra exertion and stress

in having to sleep during a period of activation. Workers from mill boiler and Bagasse baling sections are exposed to Bagasse particles which cause eye irritation and respiratory problems

**TABLE NO-1
BASIC CHARACTERISTICS AND EXPOSURE PERIOD OF THE SUBJECTS IN GENERAL OFFICE**

Sr. No	Subjects	Employment time (Months)	Cumulative exposure hours	Smoking habit / cigar and tobacco chewing
1.	NVS	72	3456	
2.	PDL	84	4032	
3.	MUK	78	3744	TC
4.	KBB	96	4608	
5.	HMP	108	5184	TC
6.	MBG	108	5184	TC
7.	KBN	102	4896	TC & CS
8.	PTS	108	5184	
9.	DPB	108	5184	
10.	WAA	150	7200	
	MEAN	101.04	4867.02	
	S.D.	20.69	993.08	
	S.E.	6.54	314.04	

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Table No. 1 indicates the age, cumulative exposure, smoking habits of the workers and the working area of the general office. It was observed that the age of randomly selected ten workers from general office ranged from 33 to 50 years and rendered long period of service upto 7200 hours of cumulative exposure. The working area of the general office is 980 m³. About 30 percent of the workers were tobacco chewers and 10 percent were both tobacco chewer and cigarette smoker

**TABLE NO- 2
BASIC CHARACTERISTICS AND EXPOSURE PERIOD OF THE WORKERS DURING
WORKING DAY IN CANEYARD SECTION**

Sr. No	Subjects	Age in years	Employment time (Months)	Cumulative exposure hours	Smoking
1.	ADS	33	108	5184	TC
2.	KSN	34	108	5184	TC
3.	JDD	35	108	5184	TC
4.	PRK	35	108	5184	TC & CS
5.	MAT	37	108	5184	TC & CS
6.	PSV	40	90	4320	TC & CS
7.	KBK	40	150	7200	
8.	VJR	44	102	4896	TC
9.	BBP	48	108	5184	
10.	MSD	57	108	5184	TC
	MEAN	40.30	109.80	5270.40	
	S.D.	= 7.16	= 14.46	= 694.19	
	S.E.	= 2.26	= 4.57	= 219.52	
	Mean Control	40.00	101.04	4867.02	50%TC 30%TC&CS

The table No. 2 indicates the age, cumulative exposure, smoking habits of the workers and the working area of the cane yard section. It was observed that the age of randomly selected ten workers from cane yard section ranged from 33 to 57 years and rendered long period of service upto 7200 hours of cumulative exposure. The working area of the cane yard is 11088 m³. About 50 percent of the workers were tobacco chewers and 30 percent of the workers were both cigarette smoker and tobacco chewer.

**TABLE NO-3
BASIC CHARACTERISTICS AND EXPOSURE PERIOD OF THE WORKERS IN MILL
SECTION**

Sr. No	Subjects	Age in years	Employment time (Months)	Cumulative exposure hours	Smoking
1.	DAS	29	60	2880	TC
2.	BPC	32	72	3456	
3.	MUS	36	60	2880	
4.	BVB	38	72	3456	
5.	MBS	38	102	4896	TC
6.	MJA	43	108	5184	TC
7.	MVB	46	108	5184	TC
8.	BSN	46	66	3168	TC
9.	BSD	50	72	3456	BS
10.	BRA	50	108	5184	TC
	MEAN	40.80	82.80	3974.40	
	S.D.	= 6.93	= 19.86	= 953.45	
	S.E.	= 2.20	= 6.28	= 301.51	
	Mean Control	40.00	101.04	4867.02	60%TC 10%TC &CS

STUDY OF EFFECT OF OCCUPATIONAL STRESS FACTORS ON PHYSICAL FITNESS SCORE.....

Table No. 3 indicates the age, cumulative exposure, making habits of the workers and the working area of the boiler section. It was found the age of the workers ranged from 36 to 54 years and rendered long period of service upto 9792 hours of cumulative exposure. The working area of the boiler section is 18060 m³. About 60 percent of the workers were tobacco chewer and 10 percent were both cigarette smoker and tobacco chewer

**TABLE NO-4
BASIC CHARACTERISTICS AND EXPOSURE PERIOD OF THE WORKERS IN BOILER SECTION**

Sr. No	Subjects	Age in years	Employment time	Cumulative exposure hours	Smoking
1.	DLB	36	84	4032	TC
2.	PMK	37	84	4032	TC
3.	ZSJ	38	96	4608	TC
4.	MTB	38	108	5184	TC
5.	DAP	41	96	4608	TC
6.	PNC	42	120	5760	
7.	JPM	43	108	5184	TC & CS
8.	GTS	45	150	7200	
9.	SSG	53	168	8064	TC
10.	PSB	54	204	9792	
	MEAN	42.70	121.80	5846.40	
	S.D.	= 6.03	= 37.76	= 1812.57	
	S.E.	= 1.91	= 11.94	= 573.18	
	Mean Control	40.00	101.04	4867.02	60%TC 10%TC&CS

Table No. 4 indicates the age, cumulative exposure, making habits of the workers and the working area of the boiler section. It was found the age of the workers ranged from 36 to 54 years and rendered long period of service upto 9792 hours of cumulative exposure. The working area of the boiler section is 18060 m³. About 60 percent of the workers were tobacco chewer and 10 percent were both cigarette smoker and tobacco chewer

**TABLE NO-5
BASIC CHARACTERISTICS AND EXPOSURE PERIOD OF THE WORKERS IN BAGASE BALING SECTION**

Sr. No	Subjects	Age in years	Employment time (Months)	Cumulative exposure hours	Smoking
1.	SVR	32	96	4608	
2.	DSV	33	102	4896	
3.	PDB	36	90	4320	
4.	KSD	37	84	4032	TC
5.	PAR	41	108	5184	TC
6.	MHS	42	108	5184	TC
7.	WRM	42	108	5184	TC
8.	SHM	42	90	4320	
9.	SRD	48	150	7200	TC
10.	MGS	50	120	5760	TC
	MEAN	40.30	105.60	5068.80	
	S.D.	= 5.60	= 18.04	= 865.92	
	S.E.	= 1.77	= 5.70	= 273.83	
	Mean Control	40.00	101.04	4867.02	60%TC

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Table No. 5 indicates the age, cumulative exposure in hours, smoking habits of the workers and the working area of the bagasse baling section. It was observed that the age of randomly selected ten workers ranged from 29 to 50 years and rendered long period of the service upto 5184 hours of cumulative exposure. The working area of the bagasse baling section is 5805 m³. About 60 percent of the workers were tobacco chewer and 10 percent were bidi smoker

**TABLE NO-6
BASIC CHARACTERISTICS AND EXPOSURE PERIOD OF THE WORKERS IN POWER
TURBINE SECTION**

Sr. No.	Subjects	Age in years	Employment time (Months)	Cumulative exposure hours	Smoking
1.	SVE	32	96	4608	
2.	DSV	33	102	4896	
3.	PDB	38	90	4320	
4.	KSD	37	84	4032	TC
5.	PAB	41	108	5184	TC
6.	NHS	42	108	5184	TC
7.	WKM	42	108	5184	TC
8.	SHM	42	90	4320	
9.	SEB	48	150	7200	TC
10.	NIGS	50	120	5760	TC
	MEAN	40.30	107.6	5068.80	
	S.D.	5.60	18.04	865.92	
	S.E.	1.77	5.70	273.83	
	Mean Centre	40.00	101.0	4867.02	60%TC

Table No. 6 indicates the age, cumulative exposure in hours, smoking habits of the workers and the working area of the power turbine section. It was observed that the age of randomly selected ten workers ranged from 32 to 50 years and rendered long period of service upto 7200 hours of the cumulative exposure. The working area of power turbine section is 5100 m³. About 60 percent of the workers were tobacco chewer

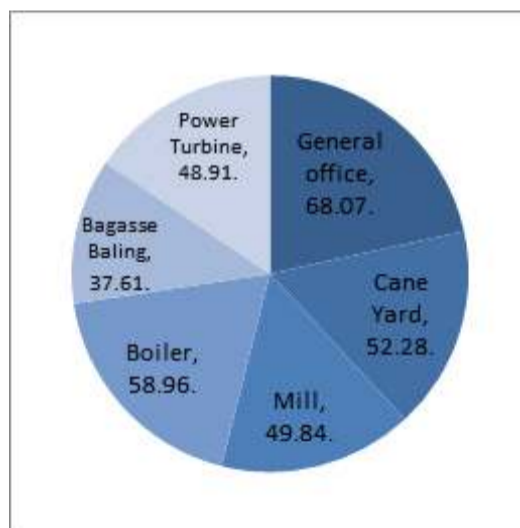


FIG.1 PHYSICAL FITNESS SCORE OF THE WORKERS WORKING IN ENGINEERING SECTION OF SUGAR INDUSTRY

Fig No. 1 indicates physical fitness score of the workers working in engineering section of sugar industry it was found that the physical fitness score of cane yard, mill boiler, bagasse baling, power turbine sections was at low average as compared to control group. Particularly workers working in bagasse baling, power turbine and mill section shows physical fitness score at significantly at low average.

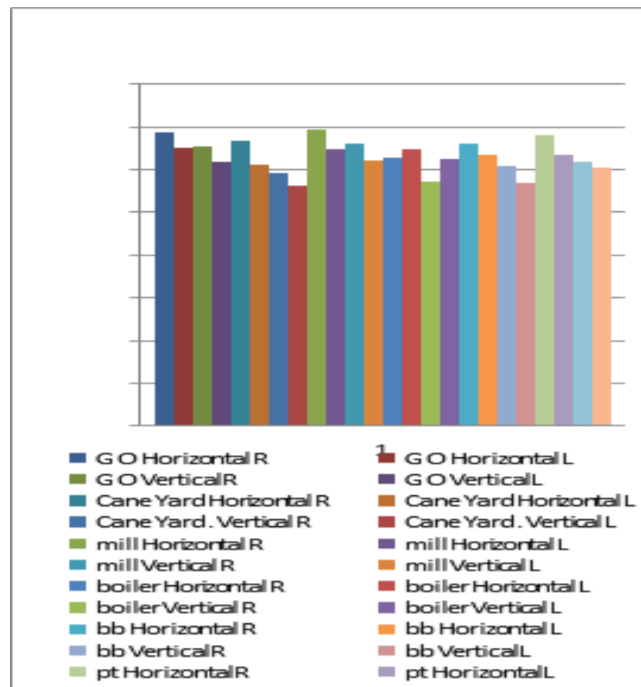


FIG.2 GRIP STRENGTH SCORE OF THE WORKERS WORKING IN ENGINEERING SECTION OF SUGAR INDUSTRY

Fig No. 2 indicates grip strength score of the workers working in engineering section of sugar industry. The grip strength study of workers working in all the sections showed poor performance as compared to control subjects.

The occupational health problems in sugar industry sector are many which are mainly attributable to a variety of occupational stresses such as noise, heat, dust, chemicals, gases,

Workplace assessment of many sugar factories indicated poor sanitary provisions, lack of personal safety equipment, high temperature, inadequate lighting, unsafe working procedure, high level of vibrations in some sections, chemical hazards, presence of bagasse particles, clay dust in air, poor ventilation and total lack of welfare facilities.

The physical fitness score of the workers working in all sections of engineering section of sugar industry indicates very poor performance due to unhealthy working conditions in cane yard sections. In all sugar industry work place high intensity noise and high temperature are common stress factors. The workers exposed to noise displayed a higher general incidence of ill health and higher rate of sickness. The noise level at power turbine section is 105 dB and in boiler section 102 dB. The worker working in mill, boiler and power turbine section are exposed to hot environment.

In boiler section the temperature is comparatively high i.e 43°C and in power turbine sections 400°C. The questionnaire survey of these works reveals that a workers have complains of excessive sweating, they are often fatigued, discomfortable and weakness is noticeable.

The high concentration of clay dust in cane yard section and bagasse dust in bagasse baling section affects the health of workers. The workers have additional stress due to rotation of shift and night shift, they have reduced amount of sleep causing the workers to feel less rested and discomfortable.

In industrial situation, the workers are exposed to various physical and social conditions which have been found to affect their health and efficiency. It is well established from number of experimental studies (Brouha, 1960) that, when work is performed the displacement of physiological and psychological functions from resting level to a higher working level require an additional energy expenditure. The subjects of present study are found to be engaged in the job for 8 hours in shift and for a longer period of years and they are acclimatized to specific working conditions. Because of poor level of education backward socio-economic conditions the sugar industry workers accept the available working conditions as allotted to them. They have no choice but they have to remain contented with that they have.

RECOMMENDATION

Based on the observations of present investigation it is recommended that the sugar industry workers should be protected from noise by offering certain hearing protectors like ear muffs or ear plugs of the non linear or active types varies with the sound level, it can also be reduced by asking the worker to wear a noise dosimeter during normal work shift. Workers should be advised for replacement of water loss at short intervals, the best fluids for rehydration are cool water or dilute fruit flavoured drink. It is also recommended to take the diet that contains enough electrolytes or freely salting food to support moderate to heavy sweating. Heat proof and flame retarded clothing should be used by the workers working near furnace, in boiler section protective clothing must be provided to the workers working in all sections of sugar industry. Ventilation also implies fresh air supply, the removal of heat and contaminants and air motion for cooling, freshening and counteracting discomfort due to humidity workers are advised to use mask to avoid inhalation of dust.

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