Musculoskeletal Disorders in Repetitive Manual Lifting and Carrying of 50 Kg. Load: A Case Study of Sugar Mill

Amandeep Singh, Manjinder Singh and Amandeep Kaur

***Abstract*— The present study was conducted in Sugar industry of Punjab to analyze the musculoskeletal disorders. There were frequent injuries and accidents in sugar industries but a little work had been done on ergonomics and occupational health of workers. In this research study, sixty (60) workers in the age group of 30-60 years performing manual lifting & carrying task were selected from sugar industry. Musculoskeletal discomfort was maximally reported in knee by 80% workers whereas low back pain was reported by 73.33% workers. The results showed that working conditions existed in the sugar mills were not satisfactory regarding ergonomics and occupational health. The study suggests that there is need to recruit the skilled manpower to minimize the injuries in sugar industry.**

***Index Terms*— Manual lifting and carrying task, Occuptional health hazards, Musculoskeletal disorder, Occupational health**

I. INTRODUCTION

Human engineering seeks to change the things people use and the environment in which they use the things to match in a better way the capabilities, limitations and need of people (Shankar, 2009).

The workers on industrial as well as agricultural sectors suffer different kind of disorders due to poor working conditions. These figures vary from minor injuries to more severe and fatal injury. There is fundamental but un-quantified rate of pain, stress, and injury as a result of ergonomic problems due to poor working measures and conditions. In many industrial countries, accidents faced by workers due to hand tools and cutting instruments were most frequent (Melville, 1999).

In India, a study was conducted on ergonomics and occupational health and safety problems of workers in sugar mills in India. They reported that more than fifty industrial units' managers participated in this study. They also mentioned that about Forty-eight percent worker suffered from low back pain, 38% of fatigue, 34% of upper-body pain, 50% of stress and 45% of dissatisfaction. They also reported that fifty-seven percent of the managers recorded a hot environment, 37% a noisy environment, and 42% a lack of resources and conveniences for the workers. Similarly it was observed more than sixty percent workers had no knowledge or awareness about ergonomics issues and 65% of the managers did not carry out an ergonomic assessment of their production sectors. They applied a significant correlation ($p<0.01$) among ergonomics issues, safety measures and average injury rates. Finally they pointed out lack of skills in ergonomics, communication and resources were the major factors

Lifting materials manually constitutes a major work activity in most industrial workplaces, even in the service industry, manual material handling activities are quite significant. Davis et al. (2010) performed asymmetric lifting tasks simulating unloading bags from a pallet using half weight bags (21.4kg). There was a 50% reduction in bag weight, the peak loads for the half-weight bags were only 25% less than full-weight and concluded that small bags reduced the spine loads by 25% as compared to the large bags. Maddamsetty (2008) found a high incidence of back injuries among workers whose job requires heavy carrying task.

Continuous bending causes backache, prolonged working hours caused feeling of weariness and prolonged movement of hand causes numbness of fingers (Gandotra et al., 2005). Occupational safety and health professionals have called these disorders a variety of names, including cumulative trauma disorders (CTD), Repeated Trauma, Repetitive Stress Injuries, and occupational overexertion syndrome (OSHA, 2000).

The prevalence of obesity is increasing at a high rate in both developed and developing countries (WHO, 1998). Obesity is defined using an index called the Body Mass Index (BMI) (Ray et al., 2011). BMI between 20 and 25 kg/m2 is considered normal weight, between 25 and 30 kg/m2 is considered overweight, above 30 kg/m^2 (Xu et al., 2008). Body mass index (BMI) and alignment affect the risk for knee osteoarthritis (OA) progression (Yusuf et al, 2011). Moreover, being overweight may affect knee joint impact rates and pain incrementally and high body weights may heighten the risk for bilateral knee joint, as well as hip joint, osteoarthritis (Marks, 2007). Zhang et al. (2000) reported relations of bone mineral density and change in BMD to risk of incident and progressive radiographic knee osteoarthritis. Obesity is also directly responsible for loss in quality of life through a reduced capacity to perform a range of common daily activities and psychological effects (Mcneil and Segal, 1999). As body weight increases then the body mass index also increase (Kaur, 2012). With aging, physical work capacity rapidly diminished even with increase in body weight (Ismailaa, 2012).

Manuscript received April 14, 2014.

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II. METHODS

The materials and methods used for the investigation are discussed under the following sub headings:

A. Selection of a process organisation

Company 'N' was selected where 50 kg sugar filled sacs were manually lifted and carried. The loading and unloading of sacs was done manually by workers, so lifting and carrying of heavy sacs was the major job component in the sugar industries.

B. Selection of the workers

A statistically adequate sample of 60 male workers in the age group of 30-60 years who were performed manual lifting and carrying task was selected from an process organization.

C. Collection of data

Data pertaining to age, education, physical activity, marital status, height, weight, mid upper arm circumference and waist to hip ratio.

D. Statistical analysis of the data

The data was analyzed statistically by using appropriate statistical tools such as mean, standard deviation and percentage. Coefficient of correlation and was also performed.

III. OBSERVATIONS

Sixty (60) male workers between the age group of 30-60 years were performing manual lifting and carrying task. At a time, six conveyors were running and four workers were working on each conveyor to lift and carriage of loaded sacs. It takes seventeen minutes to fill a truck manually so the frequency of lift of single person was 4 lift/min.

A. General information of the workers

The study was conducted on sixty (60) male workers aged between 30-60 years performing manual lifting and carrying task were selected randomly from a process organization and divided in to three age groups viz. group I (30-40 years), group II (40-50 years) and group III (50-60 years). Majority of the workers i.e. 95% were married, only 5% of the workers were unmarried. It was observed that 10% of the workers were studied up to middle standard, 30% of the workers up to primary standard and majority of the workers i.e. 60% were illiterate.

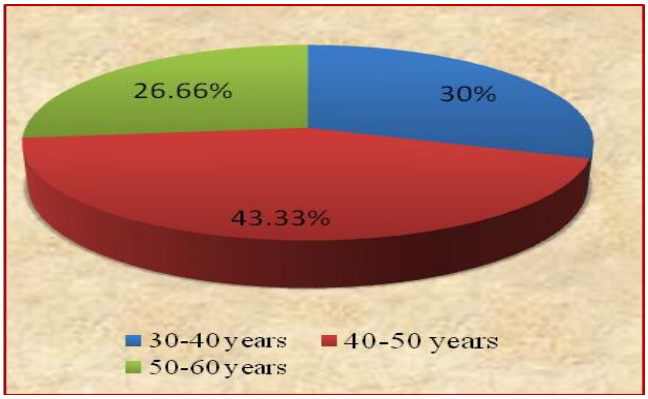

Fig 1: Percentage of Workers in each Age Group.

B. Physical characteristics of the workers

Table 1 showed that height of the workers in group I was maximum followed by group III and II respectively. There was not much variation in the weight of workers. The results of present study revealed that 24.6 to 28 kg/m^2. The mean average value of body mass index of the workers was 25.92±1.50, 26.33±2.28 and 26.42±2.16 kg/m^2 in group I, II and III respectively. BMI is directly proportional with weight, as the Weight increases BMI also increases. Ismailaa et al. (2012) studied that physical work capacity rapidly diminished even with increase in body weight. The results revealed that the workers in all the age groups were overweight, when compared to an ideal body mass index. Marks (2007), studied the relationship between the weight status of individuals, osteoarthritis and disease progression and high body weights may heighten the risk for knee joint as well as osteoarthritis. MUAC of the workers in group I, II and III was 35.33, 33.94 and 32.72 cm, respectively.

Table 1: Physical Characteristics of the Workers

Physical characteristics	Mean and Standard Deviation		
	30-40yrs	40-50yrs	50-60yrs
Height (cm)	158.66±6.45	155.34±4.04	155.25±11.18
Weight (kg)	75.8±8.13	65.7 ±7.81	67.25±5.55
BMI kg/m^2	25.29±1.50	26.33±2.28	26.42±2.16
MUAC (cm)	35.33 ±0.56	33.94 ±0.79	32.72 ±0.98

Waist hip ratio (WHR) was maximum in group II (0.92) followed by group III and I i.e. 0.90 and 0.88, respectively.

C. Sign and symptoms of the workers

The signs and symptoms of the workers are given in the Table 2. The most common symptoms observed were weakness and joint stiffness (in group I, II and III respectively. Other common experienced symptoms in group I were trouble breathing, joint locking and pain in group II were pain, joint locking and joint swelling and in group III were joint locking followed by trouble breathing

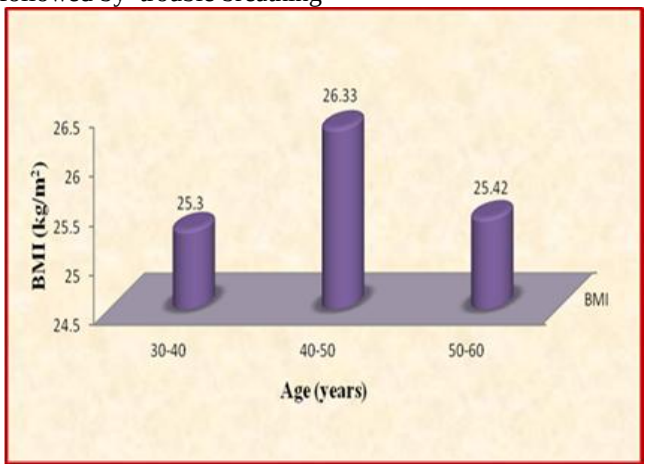

Fig 2: Body Mass Index (BMI) of the Workers

and pain. Other experienced symptoms were tingling and joint swelling in group I, trouble breathing and tingling in group II and joint swelling an tingling in group III respectively. It was observed that in group

Table 2: Sign and symptoms of the workers

Sign and Symptoms	Frequency (%age) of occurrence		
	30-40yrs	40-50yrs	50-60yrs
Pain	9 (15)	22 (36.6)	12 (20)
Weakness	11 (18)	22 (36.6)	17 (28)
Stiffness	11 (18)	19 (31.6)	14 (23)
Joint locking	10 (16.6)	13 (21.6)	14 (23)
Joint swelling	5 (8)	12 (20)	12 (20)
Trouble breathing	11 (36.6)	12 (20)	14 (23)
Tingling	8 (13.3)	7 (11.6)	4 (6.6)

Figures in parenthesis indicate percentages

II and III tingling was less experienced symptom by the workers whether weakness was most common symptom experienced by the workers in all the groups. It was observed that 80 percent of the workers were having pain in knee followed by lower back (73.33%) and neck (51.66%) in all the groups. Adoption of awkward posture during lifting and carrying loaded sacs repetitively results in musculoskeletal disorders.

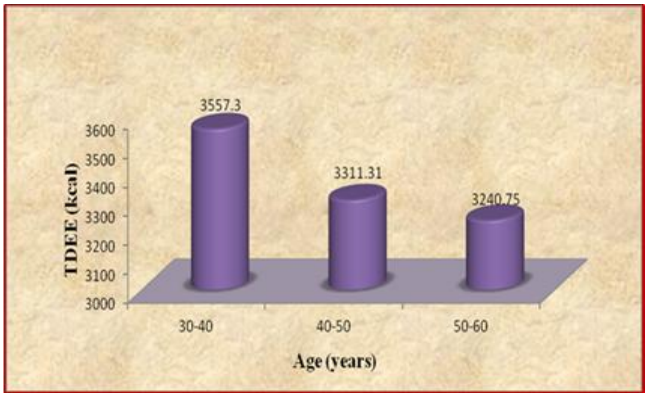

Fig 3: Severity of Pain among the Workers

The overall stress of a worker is the integrated form of physical workload and postural stress. It was observed that the workers had to bend and twist their neck and back for putting the load on the shoulder. The feeling of pain in knee and low back may be due to repetitive bending at the knee to load the sacs and carriage of load in awkward postures. The occupational work of handling loads requires high muscular effort in awkward postures giving rise to musculoskeletal strains and low back pain sign and symptoms. Turning, twisting and bending were also associated with increased incidence of low back disorders like pain, ache and discomfort.

D. Correlation coefficient between various parameters of the workers

Table 3 showed positively significant (P≤0.01) relationship between weight and BMi (r = 0.529). As weight increase BMI of the workers were also increase (Kaur, 2012). Ismailaa et al. (2012) studied that with aging, physical work capacity rapidly diminished even with increase in body weight. Table 5 also showed that there was no significant relation between age and BMI of the workers because BMI does not consider the age (Ray, 2011).

Table 5: Correlations between various parameters of the Workers

CORRELATIONS					
		Age	Weight	BMI	WH Ratio
Age	Pearson Correlation	1	.027	-.040	.156
	Sig. (2-tailed)		.836	.761	.234
	N	60	60	60	60
Weight	Pearson Correlation	.027	1	.529**	.247
	Sig. (2-tailed)	.836		.000	.057
	N	60	60	60	60
BMI	Pearson Correlation	-.040	.529**	1	.123
	Sig. (2-tailed)	.761	.000		.347
	N	60	60	60	60
WH Ratio	Pearson Correlation	.156	.247	.123	1
	Sig. (2-tailed)	.234	.057	.347	
	N	60	60	60	60

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

CONCLUSIONS

The results of the present study was concluded that musculoskeletal pain was maximally reported in knee by 80% followed by low back pain as 73.33% among the workers. The injuries of workers in sugar mills resulted due to lack of safety measures, no proper training and education program. No preventive maintenance staff was deputed at the sensitive sections of sugar mills and injuries can be reduced by adopting the basic safety measures and modifications in the existing design according the ergonomics and occupational health standards.

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