ABSTRACT

Manual material handling (MMH) work contributes to a large percentage of the over half a million cases of musculoskeletal disorders reported annually in the United States. Musculoskeletal disorders often involve strains and sprains to the lower back, shoulders, and upper limbs. They can result in protracted pain, disability, medical treatment, and financial stress for those afflicted with them, and employers often find themselves paying the bill, either directly or through workers’ compensation insurance, at the same time they must cope with the loss of the full capacity of their workers.

Scientific evidence shows that effective ergonomic interventions can lower the physical demands of MMH work tasks, thereby lowering the incidence and severity of the musculoskeletal injuries they can cause. Their potential for reducing injury-related costs alone makes ergonomic interventions a useful tool for improving a company’s productivity, product quality, and overall business competitiveness. But very often productivity gets an additional and solid shot in the arm when managers and workers take a fresh look at how best to use energy, equipment, and exertion to get the job done in the most efficient, effective, and effortless way possible. Planning that applies these principles can result in big wins for all concerned.

KEYWORDS: MMH, Ergonomics, Handicraft, DMQ, RULA, Work-Related Musculoskeletal Disorders

INTRODUCTION

What Manual Material Handling is

According to the U.S. Department of Labor, handling is defined as: Seizing, holding, grasping, turning, or otherwise working with the hand or hands. Fingers are involved only to the extent that they are an extension of the hand, such as to turn a switch or to shift automobile gears.

Types of Ergonomic Improvements

In general, ergonomic improvements are changes made to improve the fit between the demands of work tasks and the capabilities of your workers. There are usually many options for improving a particular manual handling task. It is up to you to make informed choices about which improvements will work best for particular tasks.

There are two types of ergonomic improvements:

- Engineering improvements
- Administrative improvements
The objective of the study was to assess the workstation and work postures and to study the prevalence of musculoskeletal problems on operators population.

CASE STUDY I
Impact of Ergonomic Factors in Handicraft Industries

HANDICRAFTS can be defined simply as objects made by the skill of the hand and which embody a part of the creator's personality in addition to as centuries of evolutionary tradition. Handicrafts are individualistic, therefore generally provided by informal unorganized sector artisans works.

The informal sector in India, including almost the entire craft sector, plays a significant role in the Indian economy in terms of its share in employment, output production and wealth creation.

The total workforce of 457.46 million workers in India comprises and 422.61 million (92.38%) are informal workers. Of this 92.38%, 86 % (394.90 million) are in the informal sector as shown in the Figure 1 and the remaining 6.38% (27.71million) are actually sub-contracted workers of the formal sector. Going by industry group, a sizeable number of informal sector workers are engaged in trade and manufacturing related to small scale industries and traditional industries covering Khadi and Village Industries, Handlooms, Sericulture, Coir and Handicrafts.

Musculoskeletal disorders (MSDs) are currently one of the most critical problems globally faced by the ergonomists in the workplace. In industrially developing countries, the problems of workplace injuries are extremely serious. Poor working conditions and the absence of an effective work injury prevention program in industrially developing countries have resulted in a very incidence of MSDs. The goal of the science of ergonomics is to find a best fit between worker and job environment.

Handicraft work is a tough occupation. Handicraft workers get backaches, hearing problem, breathing problem, joint, lower abdomen more than any other health problem. The reasons identified include unnatural work postures, use of hazardous chemicals, unsafe working practices, long working hours and many risks of work accidents caused by unsafe conditions.

IDENTIFIED ERGONOMIC FACTORS IN HANDICRAFT INDUSTRIES

To study the affect of the ergonomics factors in handicraft industries of Jaipur, four different handicraft sectors were chosen. Industries related to these sectors were visited and analyses were done. Through the analysis of the affecting factors some conclusions were made, which can be shown in table 1.
Table 1: Impact of Ergonomic Factors in Handicraft Industries

<table>
<thead>
<tr>
<th>Handicraft Sector</th>
<th>Ergonomic Factors</th>
<th>Impact on Handicraft Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Block Printing</td>
<td>Awkward posture in block making; Standing posture in printing; Bending posture in washing; Falls from heights</td>
<td>Increase the absenteeism of workers due to back pain, lower back, shoulders, and the cervical spine area.</td>
</tr>
<tr>
<td>Leather Handicrafts</td>
<td>Awkward posture in cutting/curving/stitching; Improper ventilation; Odor from hides</td>
<td>Increase the absenteeism of workers due to eye strain, Muscular/Body Pain, Breathlessness problem, Respiratory problem, Cuts and wound while cutting, curving and stitching, fixing etc. Odour nuisance can have physical as well as mental effects.</td>
</tr>
<tr>
<td>Blue Pottery Handicrafts</td>
<td>Improperly adjusted workstations and chairs; Awkward, limited and repetitive movements; Poor Illumination; Heat from the kiln</td>
<td>Decrement in production of company due to Muscular Pain, Chest pain, Insomnia and Abdomen pain, Shoulder Blades, Cough and Cold, gastric and digestion problems.</td>
</tr>
<tr>
<td>Metal Crafts</td>
<td>Improper Ventilation; Noise pollution; Heat; Poor Illumination</td>
<td>Increase the absenteeism of workers due to polluted air from the workplace, very high intensity noise is produced for long periods of time, work with bare bodies in front of the furnaces, poor illumination the constant pressure of work is hazardous for the eyes</td>
</tr>
</tbody>
</table>

Any physical factor within the workplace that harms the musculoskeletal system (muscles, joints, bones and related structure) of workers is termed as ergonomic hazards. Ergonomic hazards impact employers and workers and their families. Poor workplace design, awkward body mechanics or postures, repetitive movements, and other ergonomic hazards induce or contribute to a staggering number of cumulative trauma disorders that affect hands, wrists, elbows, arms, shoulders, the lower back, and the cervical spine area. Structures involved include tendons, muscles, bones, nerves, and blood vessels.

**CASE STUDY II**  
**Work Related Musculoskeletal Disorders in Cotton Spinning Occupation**

Work-related musculoskeletal disorders (WMSDs) are one of the greatest occupational health concerns today. Stooped and squatting postures are common in developing countries such as India especially in small scale industries. Most of the manually energized operations in these industries are carried out using such postures. One such industry is cotton spinning industry where operators are mostly women and 91% of them suffer from WMSDs. Cotton spinning wheel, more commonly known as “charkha”, is hand-powered device for spinning cotton yarn from pressure clamp. Spinning operation is performed in a squatting position in which operators rotate spinning wheel sitting down on the hard and flat surface with folded knees without any backrest. Figure 1 shows the details of posture adapted. The task of rotating the wheel for cotton spinning is repetitive and continuous for 8 hours of working in a day. In this condition, the back is bent excessively and postures of different parts of body dramatically deviate from the neutral. The design is essentially a compromise between the operators’ biological needs, as determined by the ergonomics guidelines and physical requirements of the equipment.

**CASE STUDY III**

The aim of this survey was to assess the extent to which small-scale enterprises involved in clothing manufacturing were complying with universal OHS standards so as to provide a first insight into the status of health and safety in these workplaces and propose interventions to improve workplace health and safety, productivity and hence the well-being of both workers and employers.
Small-scale enterprises constitute a sizeable portion of the workforce and with limited resources; they remain most vulnerable and prone to concern themselves with sustainability in business rather than the provision of a healthy and safe work environment. This provided an important motivation for the study. Moreover, there was a realization that these workplaces fall within the ambit of the Factories Act and regulations thereof that constitute the OHS legislation but inspections provided for by the Act to enforce compliance as well as reporting systems were limited or absent so that OHS conditions in the workplaces remained uninvestigated and the extent of accidents, injuries and the prevalence of work diseases also remained unmeasured.

Results of this study show that workplaces used poor electrical connections and had entangled electrical wires in their work areas exacerbating the risk of fire, burns, electrical shock and electrocution. Results also showed a very low level of fire and emergency preparedness as no workplace had a first aid kit and an insignificant number had fire-fighting equipment. Workplaces involved in clothing manufacture were also found to be affected by hazards from neighboring sites which they were generally unable to control. In the City Council clusters where the majority of sites inspected were concentrated, clothing manufacture was sandwiched between carpenters, battery charging and welding businesses. Workers in these sites were thus exposed to multiple exposures such as welding fumes and particles, wood dust and lead from batteries and excessive noise from steel cutting grinders and woodworking machines.

The gap in compliance with OHS standards as revealed by the results of this study constitutes a significant source of health problems for workers in the small-scale clothing industry. This gap also serves to confirm conclusions drawn from the literature review and shows that there is a need to introduce improvements in practically all areas of OHS in these workplaces, beginning with assistance to and training of workplaces in the benefits of OHS and basic OHS culture and organization that will enable them to accept the need to provide first aid kits, fire-fighting equipment, PPE and training in their use; redesign work benches and provide appropriate work chairs and train them in their use. This will ensure a healthy and safe work environment that enhances the physical, mental and social well-being of employees as well as increase productivity and profitability for the employers.

**DISCUSSIONS**

The results of this study revealed that the cotton spinning operators are engaged in prolonged forward bending posture in their working condition. Our study showed that 50.62% as an average value for the subjects suffering from at least one work-related musculoskeletal pain. Similar study was done by Montreuils, Laflames and Pellier on textile tufting workers handling thread cone and have reported that 64.9% had one work related musculoskeletal pain. The majority of the subjects in our study had shoulder, back and wrist pain which could be due to repetitive nature of the job and the poor design of spinning wheel. Similar findings had been reported by Punnett, Robin Keyserling in female garment workers. This is a significant support to our study. The musculoskeletal complaints are prominent in our study because the female subjects study participants were in a long sitting posture without any backrest and maintained this position for at least 8 hours a day. Grandjean has reported that sitting posture has a disadvantage because it affects digestion and breathing due to prolonged slacking of the abdominal musculature and the purported ill effect of the flexion of the lumbar spine. Since the women in our study were involved in two jobs, spinning and farm working as means of income to support their family and also being married had family responsibilities and household work also which could be a major factor for their residual musculoskeletal pain. As there is residual pain and fatigue, the productivity slows down. This compels workers to speed up the work resulting in increase in symptoms setting up a vicious cycle. Remedy is the rest, which is bypassed in the process of reaching the target. For the spinning, hand work is cyclic and both the agonists and the antagonists get some rest through the inhibition of the impulses. However, the left upper limbs and hand pulling the thread out, has no rest since the same
muscles work during pulling up concentrically and while bringing it down eccentrically. Unless the design of charkha is modified, this cannot be rectified. However in addition to the percentage of musculoskeletal complaints we have studied the working posture using Rapid Upper limb Assessment Technique developed by McAtamney and Corlett. The RULA supports to assess the postural discomfort of the operators at their average working posture. The RULA score indicates that the posture is poor and needs urgent attention for modification.

CONCLUSIONS

Handicraft sector is part of the small manufacturing industries. Significant part of Indian population is dependent on handicraft sector. Major problems associated with handicraft producing operations, awkward postures in different parts of body (i.e. neck, shoulders, elbows, wrists/hands, upper back, lower back, thigh, knees, and ankles). It is concluded that the high rate of absenteeism has an adverse effect on quality and quantity of production, efficiency of workers and organization, organizational discipline and more importantly on the organization's intention to fulfill the new market demands. Unscheduled absenteeism badly hurts the progress of an organization resulting in loss of productivity, increased costs in hiring additional staff and low morale among the workers. Several studies in different handicraft trade. Ergonomic intervention and ergonomic redesign of workstations to improve posture and working conditions helps in reducing workers discomfort and fatigue, increasing productivity and a significant reduction of employment related MSDs.

From the observation and analysis of the result it can be concluded that the female operators are working in awkward postures with the potential risks of MSDs primarily affecting shoulder and upper and lower back region. The musculoskeletal pain in study participants was high about 50% although the workload was light. The overall workload values including ergonomic environment indicates the improper design of the workstation. Excessive bending, twisting and overreaching are the resultant of poorly designed workstation. These actions in the working condition lead to the work related musculoskeletal disorders in the operators. As they have to work for longer period in the same posture in squatting positions, discomfort feeling magnitude gets amplified. The ergonomic environment also affects them to a great extent. So based on the observations made in this study it could be concluded that there is an ample scope for improvement in workplace design, work posture and ergonomic environment. Improvement in workstation design in spinning section from ergonomic view point will definitely lead to the betterment in women operators’ health and enhancement in productivity.

REFERENCES


