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P Yasotha
Assistant Professor,
Department of Costume Design and Fashion, PSG College of Arts and Science, Coimbatore,
Tamil Nadu, India

Dr. KM Pachiyappan
Head of the Department,
Department of Costume Design and Fashion, PSG College of Arts and Science, Coimbatore,
Tamil Nadu, India

M Roobiya
Post Graduate Students,
Department Of Costume Design and Fashion, PSG College of Arts and Science, Coimbatore,
Tamil Nadu, India

M Sunitha
Post Graduate Students,
Department of Costume Design and Fashion, PSG College of Arts and Science, Coimbatore,
Tamil Nadu, India

Correspondence
P Yasotha
Assistant Professor,
Department of Costume Design and Fashion, PSG College of Arts and Science, Coimbatore,
Tamil Nadu, India

Ergonomic evaluation of work place in apparel industry

P Yasotha, Dr. KM Pachiyappan, M Roobiya and M Sunitha

Abstract
The common occupational problem of the workers is musculoskeletal disorders in India. Currently the work is being carried out manually in most of the small scale industries therefore the issues of work related musculoskeletal disorders and injury in different body sites are of top priority. This ergonomic study presents assessment of work posture of workers engaged in different activities of apparel industry [1]. Since, there is a lack of ergonomics awareness, the major percentage of workers having awkward postures. Thus the workers are under moderate to high risk of musculoskeletal disorders. The purpose of this study is to look at conditions in the clothing industry to find out how these injuries starts and how they can be prevented [5].

Keywords: Cumulative trauma disorders (CTDs), Ergonomics, Garment industry, musculoskeletal disorders

1. Introduction
The clothing industry is generally seen as a safe place to work. Compared to other industries, there are relatively few serious accidents in clothing plants. The hazards we face are different. The major health risks in this industry do not arise from immediate, potentially fatal hazards [3]. Instead, the risks that clothing workers face come from more subtle hazards whose effect accumulates over time. These injuries lead to long-term health effects. This is why we wanted to look at the working conditions that can lead to such high rates of disability for clothing workers. The physical characteristics of the job are an important risk factor for muscle pain and injury [8]. The risks for sewing machine operators have been linked to conditions such as poor workstation design and chairs, and organizational factors such as the piecework system. Factors such as repetition, force, posture and vibration are associated with higher rates of injury. But you can't look at the workstation alone to understand these injuries. There is also other factors are linked to injuries. These include, High work pace, Lack of control over the job, Workload, Co-worker support and The General work environment. These factors include empowerment of the workforce, delegation of safety activities, greater seniority of the workforce, good housekeeping and an active role of top management [8].

2. Literature Review
The term ergonomics, from Greek words 'Ergo' meaning 'work', and 'Nomics', meaning 'natural laws. Ergonomics is the study of work in relation to the environment and the working people [1]. "Ergonomics is a science that focuses on designing a job for the worker". An ergonomically-designed job would ensure that a taller worker had enough space to safely perform his or her job, and also that a shorter worker could reach all of his or her tools and products without reaching beyond a comfortable and safe range. What typically happens in the workplace is that a worker is forced to work within the confines of the job or workstation that is already in place [3]. This may require employees to work in awkward postures, perform the same motion over and over again or lift heavy loads, all of which could cause work-related musculoskeletal disorders (MSD). These injuries often start as minor aches and pains. Ergonomics aims at preventing injuries by controlling the risk factors such as force, repetition, posture and vibration that can cause injuries to develop. Some fundamental ergonomic principals that should be followed in our workplaces are: Use Proper Tools, Keep Repetitive Motions to a Minimum, Avoid Awkward Postures, Use Safe Lifting Procedures, Get Proper Rest.

2.1 Use Proper Tools
Tools should be appropriate for the specific tasks being performed. Your tools should allow you to keep your hands and wrists straight – the position they would be in if they were hanging relaxed at your side. Bend the tool – not the wrist!. The tool should fit comfortably into your hand. If the grip size is too large or too small it will be uncomfortable and will increase the risk of injury. Tools should not have sharp edges, create contact stresses in your hand, or vibrate.

2.2 Keep Repetitive Motions to a Minimum
Our workstations or tasks can often be redesigned to reduce the number of repetitive motions that must be performed. Using a power-driven screwdriver or tools with a ratchet device can reduce the number of twisting motions with the arm. Some tasks can be automated or redesigned to eliminate repetitive movements and musculoskeletal injuries.

2.3 Avoid Awkward Postures
Your job should not require you to work with your hands above shoulder height on a regular basis. Arms should be kept low and close to your body. Bending and twisting of your wrists, back and neck should also be avoided.

2.4 Use Safe Lifting Procedures
Avoid lifting objects that are too heavy. Use more than one person or a mechanical device to reduce the load. Your workstation should not require you to lift objects above your head or twist your back while lifting. Keep the load close to your body and ensure that you have a good grip. Heavy and frequently lifted objects should be stored between knee and shoulder height – not on the ground or above your head.

2.5 Get Proper Rest
You need to rest your body and mind in order to prevent injuries. Give your muscles a rest during your coffee breaks, lunches and weekends by doing something different from what you do in your job. For example, if you stand all day while performing your job you should sit down to rest your legs and feet during your breaks. If you sit down when working you should stand up and walk around during your breaks to give your back a rest and to increase circulation in your legs [4].

2.6 Illness and injuries among textile workers
- 70% of sewing machine operators using foot controls report back pain
- 35% report persistent lower back pain
- 25% have suffered a compensable cumulative trauma disorder (CTD)
- 81% reported CTDs to the wrist
- 14% reported CTDs to the elbow
- 5% reported CTDs to the shoulder
- 49% of workers experience neck pains
- Absenteeism increases as working conditions worsens
- Loss of worker force due to injuries or high turnover is associated with working conditions
- Hand sewing and trimming are stressful to upper limbs
- Stitching tasks are associated with pain in the shoulders, wrists, and hands
- Ironing by hand is associated with elbow pain
- Garment assembly tasks are associated with CTDs of the hands and wrists
- Foot operated sewing is associated with pain in the back

3. Method Study
Injuries and muscle pain affecting the wrists, shoulders, neck and back are common problems for workers in the clothing industry. Ergonomics plays a key role in areas where conflicts between man and machine arises. It deals with fitting the man to the job by weaving the different components into a single system such that each components work in synchronized manner with the others. These components include the worker, the work environment–both physical and organizational, the task and the workspace. Thus recognizing ergonomic risk factors in the workplace is an essential first step in correcting hazards and improving worker protection [7].

3.1 Cutting Department

Fig 1: Fabric Roll Transportation from Table to Table

Common Problem
The heavy fabric rolls are manually transported from table to table by lifting. The people doing this operation tend to complain about back and muscle pain.

Possible solution, Automated trolleys should be used to transport fabric rolls. While loading and unloading trolleys two persons, one from each sides reduces stress and strain.

3.2 Sewing department

Common Problem

There is high risk of accidents, if needle of sewing machine break at high speed, the operators operating kansai machine have maximum possibility to face respiratory diseases. Operators performing various operations on sewing machine like single needle, double needle, kansai etc. are not provided with personal protective equipment's. Possible Solution All sewing machines should be provided with eye guard to avoid accident. The operator operating kansai machine, fabric cutter machine should be provided with respiratory protection [9].

3.3 Stitching Material

Common Problem

Employees push fabric through the sewing machine, which may require extending arms bending at the wrist, and applying force. Possible Solution Use height adjustable table which, when properly adjusted, may reduce extension and bending at the wrist. Allow the machine to pull the fabric through rather than having the operator push the fabric. Reduce the distance between the operator and machine [9].

3.4 Stain Removing Section

Actual Process

The garment with various stain such as pen mark, oil stain, etc. are removed by manually operating the stain removing machine.

Common Problem

Long standing and working hours, handling of various chemical can causes various skin injuries, long working hours lead to fatigue.

Possible Solution

Operators performing this job should be provided with protective eye glasses, hand gloves, respiratory protection, and safety shoes without fail. Operator should be provided with MSDS instruction sheet for safe handling of chemical. They should be provided anti-fatigue mat [9].

3.5 Washing Department

Incursion of material safety data sheet (MSDS) and use of personnel protective clothing was made mandatory in washing department.

3.6 Finishing Department

Higher production rates of trimming operation were recorded when use of sharp trimmers was started in finishing department. Use of measurement templates provided boom for production and reduction in stress and strain levels of workers. Improvised work surface, hand tools and work organization caused improvement in production rates and lowering stress levels at work [10].

3.7 Pressing Department

Incursion of new ventilation system reduced humidity levels thus improving working environment. Improvised postures at pressing, resulted higher production rates and lowering stress levels at work. Incursion of ergonomic irons, felicitated proper and faster working at the pressing department.

3.8 Packing Department

Improved work surface, support surface and accessories resulted in production rates and work surfaces [11].

4. Comparison between India and Pakistan:

India has carved a name for export oriented garment manufacturing center globally. The textile and garment sector alone employee 20% of work force in manufacturing sector. Textile industry contributes 14% to the industrial production. 4% GDP and 17% to the country export earning. Textile sector in Pakistan makes a significant contribution to the country export and has 8.7% of GDP. Garment industry contribution to the total textile based export from the country is 47%. Skill labor is available at relatively cheap rate. Textile sector is also labor intensive and provides employment for about 15 million people in the country (30% of total work force) [8].

5. Conclusion

Preventing physiological and psychological stress at workplace needs a lot of cooperation between workers and the management. Occupational stress can be decreased by using more suitable types of work organization, working tools and techniques, ergonomically designed work places, open discussions between the workers and the management. In order to save workers' health, recommendations were given for healthier work arrangements, working postures and movements [2]. Different prevention methods have been worked out to prevent the accidents and occupational diseases like continuous training of workers on all levels. Every workplace is different, which means employers must carry out an assessment of the risks at the workplace concerned so that solutions are developed for specific problems [6].

The modifications that we can carry out at workplaces for improvement of workers' work conditions could be divided into three groups:

5.1 Technical Interventions

Redesign of physical environment or working aids and tools, introduction or lifting and transfer aids, the rearrangement of placement of tools, providing the opportunity to use a sit/ stand stool, as well as an anti-vibration mat to reduce the fatigue caused by a permanent standing working posture, use robot manipulators, roller conveyors and conveyor belts for heavy physical work [10].

5.2. Organizational and Administrative Interventions

Work modification, job rotation, building a bridge between planning and production departments, increasing management's interest and acceptance of ergonomics, relieving physical strain on workers without reducing productivity, avoiding unnecessary lifting, carrying and repetitive work [10].

5.3 Behavioral Modification

Train the ergonomic experts who can train and educate workers for manual handling techniques, promote physical activity, raise workers' awareness of health and safety issues at work, and persuade the workers that the company values them highly [10].

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