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Ergonomic Risk Assessment Using REBA And RULA In Apparel Industry

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***Abstract*--- Ergonomics is defined as study about the designing equipment and the devices that fits human body and its movements. It also studies the cognitive abilities of the humans. It is employed to fulfil the goals of the health and the productivity of the human. Allotted ergonomic design is a mandatory one as to prevent few cases like the repetitive works, strain injuries, and so on, that may lead to long-term disability. We are trying to improve their efficiency of an operation by taking into account of a person's size, strength, visual acuity and physiological stresses such as the fatigue, speed of decision making and the demands of memory & perception. In order, we are trying to enhance the human values in the field of health, process and safety environment. As we are focusing on MSD (Musculoskeletal Disorders), we are trying to lower down them by improving the awareness of the employees and the contract workmen through the training and various exercise programmes.**

Keywords: Ergonomic Risk Assessment, REBA, Manufacturing Case Study

I. INTRODUCTION

In today's fast-paced and demanding world of Apparel, ensuring the safety of workers is of paramount importance. WMSDs are those pains, stresses and injuries to body nerves, muscles, joints and structures caused by work. These affects neck, shoulder, back, wrist etc. and are considered to be a worldwide common health problem which is often described as the causing factor of disability [1]. To address these concerns, ergonomic risk assessments becomes essential tools for identifying and mitigating workplace hazards. In particular, two widely recognized methods like Rapid Entire Body Assessment (REBA) and Rapid Upper Limb Assessment (RULA), have emerged as effective approaches for evaluating ergonomic risk factors in the apparel industry. Ergonomic risk assessment involves evaluating workstations, tasks, and work processes to identify the common potential hazards that can lead to MSDs[1, 2, 3]. By applying systematic analysis and measurement techniques, these assessments help identify ergonomic issues that arise from the awkward postures, repetitive movements, excessive force, and other risk factors. The goal is to identify and implement appropriate control measures to minimize the risk of injury and improve the overall well-being of workers. In this paper, we will explore the application of REBA and RULA in the Apparel industry and highlight their benefits in identifying and addressing ergonomic risks. By understanding the principles and methodologies behind these assessment methods, Apparel professionals can proactively create safer and more ergonomic work environments, leading to improved employee satisfaction and overall operational efficiency.

II. TOOLS USED

REBA takes into account the position of the head, neck, trunk, legs, and upper arms, providing a comprehensive assessment of the whole-body posture. By assigning a numerical score based on various criteria, likely angle and duration of postures, it helps identify high-risk tasks considering immediate attention [9]. The results of REBA and RULA assessments may guide the development of interventions and control measures to reduce the risks associated with MSDs.[5, 6] RULA, on the other hand, focuses on upper limb postures and evaluates the positioning of the arms, wrists, and hands during specific tasks [8]. This method assigns a score based on criteria such as joint angles and muscular effort, providing insights into potential issues related to repetitive movements and awkward postures. RULA assessments help prioritize tasks for intervention and aid in the design of more ergonomic workstations, tools, and equipment.[5,6]

III. METHODOLOGY

The following are the step by step procedure followed in conducting the ergonomics study in Apparel, Coimbatore. The survey provided a comprehensive understanding of the REBA and RULA methodologies. REBA focuses on assessing the entire body posture, while RULA evaluates upper limb movements. Both methodologies utilize scoring systems to consider the level of risk and guide subsequent interventions. Numerous studies demonstrated the accuracy of REBA and RULA in evaluating ergonomic hazards specific to apparel industries. These assessments facilitated the process of risk factors such as awkward postures, repetitive motions, and excessive force exertion, which are common contributors to musculoskeletal disorders in this sector.

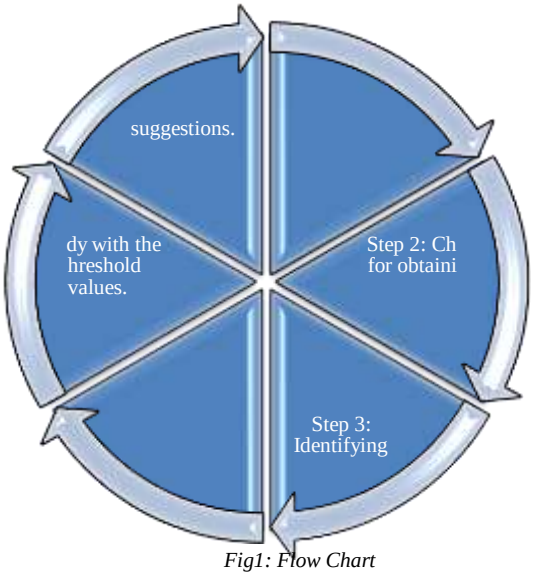


Fig1: Flow Chart

A. Initial discussion on the entire plant activities:

Explanation: In this step the entire manufacturing process carried in the factory was carefully studied and understood by conducting departmental visit.

B. Chart for obtaining an overview of the task:

Explanation: In this step overview of the task performed by the worker is obtained by observing and filling about task overview chart. After thorough study of entire work activities at industries, the entire work tasks that will be carried out are studied using the following chart.

C. Identifying the work tasks which need further assessment:

Explanation: In this step ll the tasks which need further assessment are/is identified from the work task overview chart. After completion of analyzing all the work tasks of the location using the chart we arrive at all the crucial tasks which need further assessment.

D. Assessment using the proper economic tool:

Explanation: After identifying all tasks which need further assessment, proper Ergonomic tools like REBA, RULA, are used to determine the suitability and results are being sorted out.

E. Comparing the findings of study with the threshold values:

Explanation: The findings obtained from the above tools are associated with the threshold values specified therein.

F. Recommendations and suggestions

Explanation: Based on the results from the assessment tool necessary recommendations and intervention strategies are suggested.

IV. Data Collection and Analysis

1. Design/ accounts and HR dept.

In this sector, the employees are working continuously sitting in PC to design equipment and drawing.

2. Planning and central material storage.

In this sector, the employees are removing and placing the binned products from the rack frequently as required by the production department.

3. Production area.

In this sector, the employees are carrying the raw materials are being transported by using manual or power tools.

4. Quality/ assembly section.

In this section, the employees are working in assembly are continuously sitting or continuously bending for long hours using power tools for assembly related jobs.

5. Canteen

In this section, the employees are cleaning and washing the food plates manually in the washing area.

A. Ergonomic study at design/ account and HR dept:

Chart for the predicted overview of the Task	
Task	Working in PC
Location	Design / Account Section
Date	27/02/2023

Table 1

Element	*Issues*	*Problem noted by workers or observers*	*Need further assessment*
Work Task	Actions and movements	No	No
	Working pressure and position	Yes	Yes
	Location of load and distance moved	No	No
	Repetition of the tasks	Yes	Yes
	Sustained attention or monotony	Yes	Yes
	Duration of the task	Yes	Yes
	Matching with worker's experience	No	No

Work Load	Suitability of equipment used	Yes	Yes
	Physical and Muscular Load	No	No
	Mental and Psychological Load	Yes	Yes
	Potential over Working	No	No
Work Environment	Space, Access and Workplace Layout	No	No
	Hazards, particular to the work environment	No	No
	Need for personal protective equipment(PPE)	No	No
	Need for special devices	No	No
Work Organisation	Working time arrangements	No	No
	Workflow and Availability of materials	No	No
	Adequate number of workers	No	No
	Availability of Assistance	No	No
	Effective procedures for reporting	No	No
Individual Capability	Physical and Mental Capabilities	No	No
	Age & Associated Changes	Yes	Yes
	Education & Skills	No	No
	Training for the tasks	No	No
	Special needs including Disability	No	No

Chart 1

B. Planning and central material storage:

The work task overview chart was filled by the employees working at the planning stores and CMC where their routine activity is retrieval of binned materials from the Horizontal racks as required by the production control and keeping them back and the analyzed results are as follows.

Chart For Obtaining an Overview of the Task	
Task	Retrieval of binned materials from the rack
Location	Planning and Central Material Storage
Date	27/02/2023

Table 2

Element	*Issues*	*Problem noted by workers or observers*	*Need further assessment*
Work Task	Actions and movements	No	No
	Working pressure and position	Yes	Yes
	Location of load and distance moved	Yes	Yes
	Repetition of the tasks	No	No
	Sustained attention or monotony	No	No
	Duration of the task	Yes	Yes
	Matching with worker's experience	No	No
Work Load	Suitability of equipment used	No	No
	Physical and Muscular Load	Yes	Yes
	Mental and Psychological Load	No	No
	Potential over Working	No	No
Work Environment	Space, Access and Workplace Layout	Yes	Yes
	Hazards, particular to the work environment	Yes	Yes
	Need for personal protective equipment(PPE)	No	No
	Need for special devices	No	No
Work Organisation	Working time arrangements	No	No
	Workflow and Availability of materials	No	No
	Adequate number of workers	No	No
	Availability of Assistance	No	No

	Effective procedures for reporting	No	No
Individual Capability	Physical and Mental Capabilities	No	No
	Age & Associated Changes	No	No
	Education & Skills	No	No
	Training for the tasks	Yes	Yes
	Special needs including Disability	No	No

Chart 2

C. Production area:

The work task overview chart was filled by the employees working in production area the employees are carrying the raw materials transported by using manual or power tools.

Chart for obtaining an overview of the task	
Task	Carrying the raw material
Location	Production Area
Date	01/03/2023

Table 3

Element	*Issues*	*Problem noted by Workers or Observers*	*Need Further Assessment*
Work Task	Actions and movements	No	No
	Working pressure and position	Yes	Yes
	Location of load and distance moved	Yes	Yes
	Repetition of the tasks	No	No
	Sustained attention or monotony	No	No
	Duration of the task	Yes	Yes
	Matching with worker's experience	No	No
Work Load	Suitability of equipment used	No	No
	Physical and Muscular Load	Yes	Yes
	Mental and Psychological Load	No	No
	Potential over Working	No	No
Work Environment	Space, Access and Workplace Layout	Yes	Yes
	Hazards, particular to the work environment	Yes	Yes
	Need for personal protective equipment(PPE)	No	No
	Need for special devices	No	No
Work Organisation	Working time arrangements	No	No
	Workflow and Availability of materials	No	No
	Adequate number of workers	No	No
	Availability of Assistance	No	No
	Effective procedures for reporting	No	No
Individual Capability	Physical and Mental Capabilities	No	No
	Age & Associated Changes	No	No
	Education & Skills	No	No
	Training for the tasks	Yes	Yes
	Special needs including Disability	No	No

Chart 3

D. Ergonomic study at quality/assembly section:

The work task overview chart was filled by the employees working in quality/ assembly section where their process activity is long hour of continuously sitting or bending posture and the analyzed results are as follows.

Chart for obtaining an overview of the task	
Task	Continuously sitting and bending posture
Location	Quality / Assembly Section
Date	03/03/2023

Table 4

Element	*Issues*	*Problem Noted by Workers or Observers*	*Need Further Assessment*
Work Task	Actions and movements	No	No
	Working pressure and position	Yes	Yes
	Location of load and distance moved	Yes	Yes
	Repetition of the tasks	Yes	Yes
	Sustained attention or monotony	No	No
	Duration of the task	Yes	Yes
	Matching with worker's experience	No	No
Work Load	Suitability of equipment used	Yes	Yes
	Physical and Muscular Load	Yes	Yes
	Mental and Psychological Load	Yes	Yes
	Potential over Working	No	No
Work Environment	Space, Access and Workplace Layout	No	No
	Hazards, particular to the work environment	No	No
	Need for personal protective equipment(PPE)	No	No
	Need for special devices	No	No
Work Organisation	Working time arrangements	No	No
	Workflow and Availability of materials	No	No
	Adequate number of workers	No	No
	Availability of Assistance	No	No
	Effective procedures for reporting	No	No
Individual Capability	Physical and Mental Capabilities	No	No
	Age & Associated Changes	No	No
	Education & Skills	No	No
	Training for the tasks	Yes	Yes
	Special needs including Disability	No	No

Chart 4

E. Ergonomic study at canteen

The work task overview chart was filled by the employees working in dish washing area (canteen), where their routine job work is cleaning and washing the food plates and the result of the analysis are as follows.

Chart for obtaining an Overview of the Task	
Task	Cleaning and Washing of food plates after use
Location	Canteen
Date	06/03/2023

Table 5

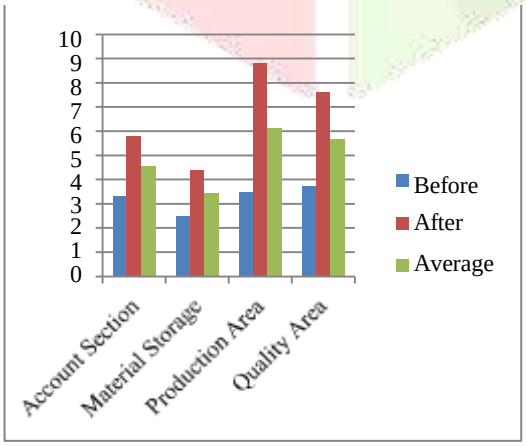
Element	*Issues*	*Problem noted by Workers or Observers*	*Need Further Assessment*
Work Task	Actions and movements	No	No
	Working pressure and position	No	No
	Location of load and distance moved	No	No
	Repetition of the tasks	No	No
	Sustained attention or monotony	Yes	Yes
	Duration of the task	Yes	Yes
	Matching with worker's experience	No	No
Work Load	Suitability of equipment used	Yes	Yes
	Physical and Muscular Load	No	No
	Mental and Psychological Load	No	No
	Potential over Working	No	No

Work Environment	Space, Access and Workplace Layout	Yes	Yes
	Hazards, particular to the work environment	No	No
	Need for personal protective equipment(PPE)	Yes	Yes
	Need for special devices	No	No
Work Organisation	Working time arrangements	No	No
	Workflow and Availability of materials	No	No
	Adequate number of workers	No	No
	Availability of Assistance	No	No
	Effective procedures for reporting	No	No
Individual Capability	Physical and Mental Capabilities	No	No
	Age & Associated Changes	No	No
	Education & Skills	No	No
	Training for the tasks	Yes	Yes
	Special needs including Disability	No	No

Chart 5

V. RESULT DISCUSSION

Based on chart study, observation, interaction with workers/officers, the following areas are identified and as MSD risk prone areas.



Pie Chart

A. Finding and Recommendation in design/account section:

Fig 2 Design Section

Sl.no	*Risk Assessment Tools*	*Score*	*Findings*
01.	Rapid Upper Limb Assessment Tool	6/6	Investigation and changes are required.

Findings Sheet in Design Section

Risks in the computer operating tasks which lead to musculoskeletal disorders are

1. Awkward neck positions, shoulder positions, elbow bend, wrist bend , or back postures while working should be avoided.

2. Don't type for too long in the keyboard.

3. Don't force your hand and wrist while typing or using the mouse.

Recommendation for Company:

1. When sitting

Long periods of time spent in the same seated position slow blood flow, which causes fatigue in the worker. The neck, shoulders, and back muscles deteriorate. Take advantage of opportunities to stand up and move around. Stand up and reach for the overhead bin instead. Place the printer farther away so that the employee must get up and walk there rather than reaching for it. Get up and grab a cell phone. By moving around, you keep your blood flowing and keep your muscles from getting tired or cramping.

2. When keying

While typing always ensure the following points to reduce the risk of MSDs.

a. Keyboard should be at right height.

b. Ensure shoulder are relaxed, elbow are close to the body.

c. Elbow must be bent at least slightly past 90 degrees.

d. The tops of the "home row" keys are either slightly below or at the same level as your elbows.

e. Wrists are straight (not bent)

3. When positioning the cursor with a pointing Device

The shoulders, neck, elbows, wrists, and hands may suffer computer-related injuries as a result of pointing devices like the mouse and trackball. Reaching, gripping, pivoting at the wrist, finger clicking, and holding the button while dragging the mouse are typical motions related to such devices. Those actions and the static arm position could eventually lead to issues. It is crucial to access a pointing device while keying without extending too far or adopting awkward postures. For that, placing the pointing device as close to the keyboard as possible is advised. *Recommendation on organizing the work space:*

1. Reaches performed frequently are within the near work space.

2. Reaches performed occasionally are within the near or mid work space.

4. When viewing the monitor

(1) Monitor height:

When the worker is seated at the workstation properly and comfortably, the horizontal line of sight determines the maximum height of the viewing range. When a monitor is too high, the user will tilt or tip their head back to look up at it. Pine in the neck, shoulders, and upper back may develop over time. Because people tend to blink less when looking up, the worker might also notice dry eyes.

(2) Monitor Distance

The following points are to be ensure while viewing the monitor

1. Alternate the view occasionally to something behind the monitor. Allow your eyes to rest.

2. Rest your eyes occasionally by closing them for five seconds.

3. Changing the monitor's brightness and/or contrast

4. To increase the display percentage, zoom in.

5. Repeatedly blink your eyes.

Finding and Recommendation in Material Storage Area:

The following are the findings of Ergonomic tools application in storage area.

Fig 3 Storage Area

Sl. no	*Risk assessment tools*	*Score*	*Finding*
01	Rapid Upper Limb Assessment tool	7/7	Investigation and changes are required immediately

Findings in Storage Area

Recommendations for Company

1.Horizontal rack shall be replaced with vertical creosols.

2. Easy retrieval of materials from the racks.

3. Avoid using step ladders to remove materials from the top rows.

Finding and Recommendation at Production Area:

- ☐ Working in uncomfortable neck, elbow, or back positions.
- ☐ Constant pressure on the wrist, arm, and elbow when bending
- ☐ Posture when removing the raw material from the rack and picking it up again.

Fig 4 Production Area

Recommendations for Company:

- Avoid lifting of Raw material manually as when required.
- Check for availability of Raw material lifting machines.
- In near future, handling of Raw material shall be carried out using the available mechanism.

Lifting and lowering tasks ergonomics design:

To avoid having to manually lift heavy or bulky materials and to lessen needless bending, twisting, and reaching when lifting materials, the following checklist must be used.

- ☐ Minimize manual handling of the material. Establish sufficient areas for receiving, storing, and shipping.
- ☐ Remove the need for manual lifting and lowering
- ☐ Make it heavier, requiring mechanical handling.
- ☐ Lighten the item's weight
- ☐ Closer proximity of the hands to the body • Change a lift/lower and carry combination to a push or pull

VI. CONCLUSION

To sum up, ergonomic risk assessments like REBA and RULA must be used in the apparel industry to protect the health and wellbeing of employees. Organizations can create safer and more effective work environments that ultimately benefit both employees and the business as a whole by methodically evaluating and addressing ergonomic hazards. The apparel industry can take steps to ensure a long-lasting and healthy workforce by adopting ergonomic principles. It is crucial to remember that REBA and RULA are tools that should be used in conjunction with other ergonomic considerations and practices rather than standalone solutions. A successful ergonomic risk management system requires ongoing employee involvement and feedback, as well as regular reviews and reevaluations of tasks and workstations.

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