

# **WERA-Based Ergonomic Risk Assessment in Thread Manufacturing: A Case Study**

**Balaji R**

Student, M. Tech Industrial Safety Engineering  
Kalasalingam Academy of Research and Education  
Krishnan Koil, Srivilliputhur, Tamil Nadu, India  
balajirengaraj1997@gmail.com

**Raj Pradeesh T**

Assistant Professor, Department of Mechanical Engineering  
Kalasalingam Academy of Research and Education  
Krishnan Koil, Srivilliputhur, Tamil Nadu, India  
rajpradeesh29@gmail.com

## **Abstract**

This case survey assessment contributes to the Workplace Ergonomic Risk Assessment (WERA) tool to review the ergonomic risk factors related to Musculoskeletal Disorder (MSD). This case study was conducted in the thread manufacturing industry in the southernmost part of Tamil Nadu. Within the legality trial, the connection between the individual WERA body part scores to the improvement of pain or inconvenience is factually critical for the wrist, shoulder, and back areas. It suggests that the WERA assessment will provide a good suggestion for a musculoskeletal issue, which may be recorded for pain, ache, or discomfort in the significant employee. It is an observational technique to assess the work rapidly and identify the ergonomic risk factors associated with physical hazards. This work aims to reduce the ergonomic risk factor by introducing some recommendations to improve the workstation and reduce the employee's discomfort. This research will increase the awareness of the ergonomic risk factor, which may occur in the thread manufacturing industry.

## **Keywords**

Ergonomics, Musculoskeletal Disorder, Risk assessment, Hazard, WERA.

## **1. Introduction**

In India, cotton spinning is a significant activity at both the small-scale and large-scale material industry levels. Mostly, women employees are associated with cotton milling handling in embracing a hunching down stance in customary workshops in these industries. They are observed and assessed with the Rapid Upper Limb Assessment (RULA) system, and their presentation to WMSDs was surveyed. It is uncovered that turning and twisting are the result of ineffectively designed workstations. Work-related Musculoskeletal Disorder (WMSDs) is one of the most pressing concerns related to well-being today. Ergonomics is the craftsmanship that uses technical information and the employee's information about their work circumstance. Psychosocial work hazards, including high mental interest and low work environment equity, are significant industry-related hazard factors for shoulder and neck issues. At the same time, ergonomic dangers are significant business-related hazard factors for lower back and wrist or hand issues. Ergonomics in the material and clothing industries is applying current robotisation advancements to texture handling. Employees engaged with sewing machine exercises as assembling articles of clothing, are at a hazard creating musculoskeletal clutters. In little scope material ventures, OHS and ergonomics issues are connected with the

production. Ergonomics is the logical utilisation of the standards and strategies to draw information from different controls to advance the framework in which individuals play a critical role. In the articles of the clothing industry, numerous activities are tedious, and dreary sorts of work cause musculoskeletal clutters. Moves ought to be made to eliminate the reasons for these disarranges and make the workplace a safe and sound environment for the employees. Numerous dangers may negatively influence the strength of workers in work environments. These dangers are significant issues since the two of them can prompt a mishap, injury, or medical issue and unfavourably influence the profitability of the business.

Research has reliably focused on the physical attributes of the occupations are a significant hazard factor for muscle injury. The dangers for sewing machine administrators have been connected to conditions, for example, poor work design and seat and organisational factors, for example, the piece work plan. Variables like redundancy, power, stance, and vibrations are likewise connected with a higher rate of injuries. Employees engaged with sewing exercises, for example, fabricating pieces of clothing, create musculoskeletal injuries. In this way, it is basic that the structure of fine work, scissors work, and materials should be ergonomically proper. The article related to clothing plants is tedious and dreary, requiring solid visual requests, ill-advised postural necessities, including extended periods sitting or remaining in one position. It is suggested that the seat posture is right when the work surface is at the elbow height and the sole of the floor. Frequent scheduled breaks and little breaks to stretch and change position are basic. Height and tilt customizable tables can assist representatives in accessing their work without utilising a position. Edges of the work surfaces ought to be cushioned or adjusted so the employees can move easily. Customizable lighting and amplifying glasses for work stations can be utilised. Lifting of weight should be possible at the midsection level. Work in clothing industrial facilities is dull and tedious, requiring solid visual requests and inappropriate postural requirements, including extended periods, sitting or remaining in one position. In experts and talented employees, MSDs of the neck and shoulders are increasingly pervasive, while in manual employees, MSDs of the hands, wrists, and lower back are progressively predominant. The material and clothing industry is one of the most driving portions of the Indian economy. The employee who is involved in the activities of the sewing machine in a thread manufacturing industry is at risk will developing musculoskeletal disorders. In these industries, physical health problems and ergonomic risks are related to the production. The majority of the physically demanding employees in these industries are facing this issue. It is uncovered that about 91% of women employees are experiencing WMSDs in the cotton spinning industry.

### **1.1 Objectives**

To assess ergonomic risks for employees in the cotton spinning, clothing, and thread manufacturing industries using observational techniques like WERA and RULA. To find out how common work-related musculoskeletal disorders (WMSDs) are among employees, specifically among female employees, in the neck, shoulder, wrist, back, and lower limbs. To look at the relationship between the start of musculoskeletal discomfort and injury and workstation design, posture, and repetitive tasks. To evaluate the organisational and behavioural factors that lead to musculoskeletal health issues, such as repetitive work schedules, high expectations for one's work, and a lack of job control. The use of adjustable lighting and seating, improved office design, posture correction, and scheduling rest periods are all examples of ergonomic recommendations that should be implemented to reduce physical strain. To improve occupational health and safety (OHS) practices and enhance awareness of ergonomic dangers in the textile and clothing industries, both large and small. To verify the use of instruments such as RULA and WERA for detecting risk factors and guiding treatments, thereby promoting the expansion of ergonomic risk assessment processes in India's textile sector.

## **2. Literature Review**

Felekoglu et al. (2020) propose a new tool that has been proposed in the workstation. The interactive Ergonomic Risk Mapping (intERM) methodology is introduced for developing this tool. Using the interactive tool enables the ergonomic risk to be eliminated and reduced, and increases the company-wide awareness of ergonomics risks. Liu et al. (2020) described the relationship between ergonomic and psychosocial work dangers with the dangers of MSDs of specific body parts and their circulation over a wide scope of work-related groups. A self-report survey was conducted to acquire data concerning segment attributes, work conditions, ergonomic and psychosocial work hazards, and MSDs of various body parts in a year. Muthukrishnan et al. (2020) describe the hazard introduction level of nursing assignments and investigate the relationship with ergonomic factors such as hierarchical, psychosocial, and environmental work factors. Additionally, the relationship between the hazard introduction levels of nursing assignments is pervasively related to musculoskeletal disorders (WMSDs). The hazard presentation scores were

altogether connected with the revealed WMSDs of the lower back, neck, and hip areas; these forestalled typical exercises at any rate once in the last 12 months.

The research of Mufti et al. (2019) evaluates work hazards brought about by non-ergonomic aspects of both office design and working environment at some Small and Medium-sized Enterprises (SMEs). The research members are individuals who have worked for over ten years. The evaluation result by actualising WERA shows that the employees experience a chance with a definite score of 30 at the medium level, concerning the specialist who cuts the design of the garments, is at a significant level, 45. It implies that a few proposals to improve the working environment are of imperative significance. The ergonomic structure presented in this research can decrease the hazard in some small-scale industries.

Tarafder (2019) discussed that in the textile industry, the role of ergonomics plays a vital role in increasing productivity. This research shows that the improvement in the work station has occurred in many studies, and by focusing on the current conditions of the workers' survey in terms of ergonomics. During this observation procedure, Paramount Textiles has been creating and improving as an ergonomics culture, coordinating with the general speaking procedures of the executives. Sugiono et al. (2018) have analysed the wiring hardness workstation and taken the ergonomic survey in the torque job, grommet job and offline job. According to the WERA ergonomic survey results, some workers have suffered pain in the shoulder, neck, and hands. By following the proper recommendations and modifying the workplace, the workers do not feel any discomfort doing the work.

Selki (2017) discussed that the fundamental point of this research is a review of the Ergonomic program. The objective is to characterise ergonomically. The investigation discovered that ergonomic set-aside cash improves quality, profitability, worker morale and creates a better security culture. The inquiry accepts that the most significant components of a successful ergonomic program are the board and training program. Rahman et al. (2017) proposed that this research was led by utilising two different methods, which were the Nordic Musculoskeletal Questionnaire (NMQ) as a review and the Washington Industrial Safety and Health Act (WISHA) checklist as an immediate observation technique. At the same time, the WISHA checklist encountered a hazard level, including an awkward position and high hand power. From this research, musculoskeletal disorders (MSDs) and ergonomic hazard factors (ERFs) are related, as it is indicated that musculoskeletal disorders may emerge if the employee overlooks the safety in ergonomic hazards.

Mukund et al. (2014) showed that this work has been significantly completed in other Asian countries, and it was comprehended that inadequately structured workstations contribute to musculoskeletal disorders of the neck, shoulders, and upper limbs, collectively known as repetitive strain injuries (RSIs). The researchers also present an ergonomic appraisal of the workstations in cutting and sewing segments of the textile industry in Bangalore, focusing on identifying proof of the "awful ergonomics" prompting employees' health issues, and propose recommendations for creating ergonomic workstations, as per the OSHA norms. Jaffar et al. (2011) propose the structure of the ergonomics hazard factors in the development industry. The goal is to give an introductory presentation and be away from ergonomic issues. The research will incorporate the ergonomics hazard factors in the connection between human and their tendency to work. This research will improve attention to the hazard factors, which may occur in the development business.

Rahman et al. (2011) describe the improvement of the Workplace Ergonomic Risk Assessment (WERA) for examining the physical hazard factor related to business-related musculoskeletal disarranges (WMSDs). In the dependability and ease of use preliminaries, the input poll overview about the ease of use of the WERA instrument, all members, including master and supervisory groups, concurred that the model of the WERA device is rushed to utilise, relevant to work environment appraisal for the wide scope of employment/assignment and significant at work. Tae Yang et al published a paper under the title "Types of manual materials handling (MMH) and occupational incidents and musculoskeletal disorders (MSDs) in motor vehicle parts manufacturing (MVPM) industry", mentioning that occupational incidents and musculoskeletal disorders (MSDs) caused by MMH occur within the MVPM industry. This reflection shows the outlines of occupational incidents and MSDs, and also the most potent and wicked incident conformable with the categories of MMH and affecting growth.

Practical, empirically supported ergonomic solutions for textile workplaces are highlighted in recent research. Das (2023) measured significant WMSD exposure among workers in the cotton and apparel industries, attributing risk to

extended, uncomfortable postures and repetitive jobs. A detailed case study by İmamoğlu (2024) showed that certain workstation dimensions, task sequencing, and microtasks increase strain on the neck, shoulders, and lower back. According to a comprehensive review by Santos et al. (2025), multimodal treatments such as task redesign, engineering modifications, and work-rest scheduling result in the highest decreases in symptom reports and observational risk ratings. When taken as a whole, these studies provide low-cost, scalable ergonomic solutions for small-scale textile operations. Long-term health consequences should be clinically assessed in future studies.

### 3. Methodology

This data has been taken by observing the employees who have been working for over 10 years with a redundant working example. It is a direct observation. This working procedure has been recorded, and employees have been interviewed. These activities cause weakness and give rise to work hazards among employees. Ergonomic static posture evaluation using the activity of each posture can be examined by utilising the camera (Figure 1).

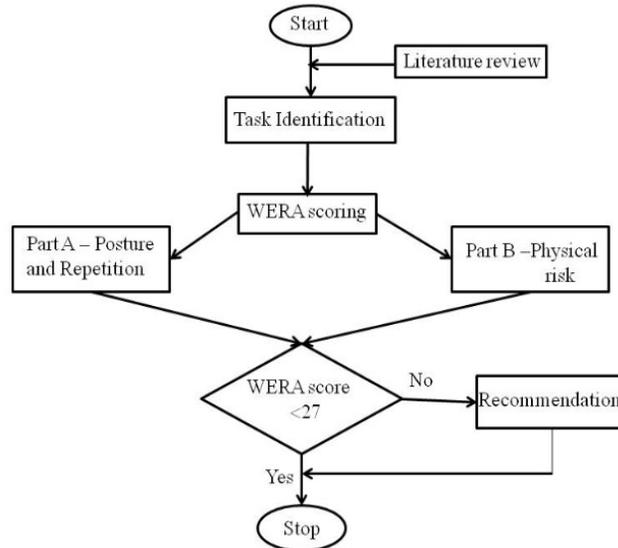


Figure 1. Flow process of the WERA method.

#### 3.1. Workplace Ergonomic Risk Assessment (WERA)

The work engineering Risk Assessment (WERA), which is AN empirical tool, was developed to supply a technique of screening the operating task quickly for exposure to physical risk issues related to Work-related musculoskeletal Disorders (WMSDs). The WERA puppet covers the six physical try factors together with deport, recapitulation, drastic, ambience, conjunction accent and task period, and it involves the 5 primary body regions (shoulder, wrist, back, neck and leg). It's a marking system and action levels which offer a guide to the amount of risk and the need for action to conduct a lot of careful assessments. This tool has been tested on its reliability, validity and usefulness throughout the event process. Because the WERA tool could be a pen and paper technique that may be used with no special equipment, it can also be used in any house of works while not disruption to the workforce. WERA is the modified version of the REBA tool for the entire body assessment, also it is also considered an observational tool. The body pain and discomfort were reported with the WERA assessment because they have a relationship to work-related musculoskeletal disorders. The WERA is an assessment system to provide proper guidance on risks to be evaluated during the work task. This assessment system has no special equipment for the evaluation; it is considered a paper-and-pen technique. The WERA assessment considers the five major body parts and six physical risk factors for the assessment of work tasks. The work task screening by the WERA method is followed by the stages.

- Stage 1: Observe the work task.
- Stage 2: Collect the relevant data.
- Stage 3: Risk factor recording;
- Stage 4: Scoring system;
- Stage 5: Instruction and recommendations

The Workplace Ergonomic Risk Assessment (WERA), which is an observational Technique, was created to give a strategy for rapidly screening the working errand rapidly for the introduction of physical hazard factors related to Work-related Musculoskeletal Disorders (WMSDs). Figure 1 shows the flow process of the WERA method, and this is the procedure for doing the WERA risk assessment. The employee's body pose and the development of the other body parts were caught and analysed by utilising the WERA technique. The WERA instrument spreads the six physical hazard factors, including posture, repetition, force, vibration, stress and duration of task or work, and it includes the five primary body districts (shoulder, wrist, back, neck, and leg). It has a scoring framework and activity levels, which give a manual for the degree of hazard and requirement for the activity to direct progressively nitty-gritty evaluations. This device has been tested on its reliability, validity, and ease of use during the advancement procedure. As the WERA instrument is a pen and paper procedure that can be utilised with no exceptional gear, it should also be possible in any work environment space without interruption to the workforce.

**3.2. Procedure for using the WERA method:**

a) Observe the task:

Follow the task to figure out a general ergonomic working environment appraisal, including the effect of work format and condition, utilisation of hardware, and the conduct of the specialist regarding hazard taking. On the off chance that it is possible, record information using a photo or a camcorder.

b) Select the task:

Select which task will be analysed from the observation. These are the following criteria are to be used for selecting the task,

1. Repetitive work.
2. Extreme awkward posture
3. The employee finds it difficult to do the task.
4. Work required high forces, stress, and vibration.

c) Give the risk score for the task:

Each description of the job has a separate risk factor, which includes PART A and PART B.

1. PART A includes the shoulder, wrist, back, neck, and leg.
2. PART B includes force, vibration, stress, and job duration.

d) Calculating & considering the score:

1. Calculate each PART A and PART B score and the final score.
2. Table 1 shows that each part has a risk score level by comparing that score, the job is considered high, medium, or low.

Table 1. WERA risk assessment matrix (PART A + PART B)-action levels and score ranges

Risk level	Score	Action
Low	18 – 27	Task accepted
Medium	28 – 44	Require change
High	45 – 55	The task is not accepted.

e) Recommendation:

- Based on the risk score, the recommendation has to suggest reducing the hazard and improving the workplace.
- If the score becomes above 45, it is mandatory to provide a suggestion which will reduce the risk factor and reduce the discomfort of the employee.

## **4. Problem Identification**

### **4.1. Ergonomic Hazard:**

An ergonomic hazard is a state of being that may present danger of injury to the musculoskeletal system, for example, the muscles or tendons of the lower back, ligaments, or nerves of the hands/wrists, or bones encompassing the knees, resulting in a musculoskeletal issue (MSD). After realising the ergonomic risk factor in the working environment, the first crucial step is to correct the potential risk and improve the workstation. The inefficient working time and cost expansion are the main causes of musculoskeletal symptoms. The main factor and the most important risk factor, which indicates musculoskeletal symptoms, is body posture, its existence, related to work, and the workplace. Ergonomic perils incorporate unbalanced stances, static stances, huge forces, monotonous movement, or short interims between actions. The focal point of ergonomics execution should eliminate obstructions to quality, efficiency, and safe human execution by fitting items, undertakings, and situations to individuals instead of driving the individual to adjust to the work. To evaluate the fit between an individual and their work, ergonomists will think about the employee, the working environment, and the activity structure. In this way, the goal of an ergonomics program is to provide a sheltered and profitable working environment to the specialist's solace to satisfy the objectives and destinations of the association.

Koppiahraj, K et al. (2019) identified suitable Ergonomics Risk assessment methods using the Fuzzy VIKOR Methodology to minimise the exposure faced by the industrial workers. Sivaprakasam Rajakarunakaran et al. (2014) Evaluate the risk using the Fuzzy Expert analysis in the LPG Refuelling Stations. Koppiahraj Karupppiah et al. (2020) Identify the Ergonomic Evaluation factors present in the workplace in Leather Garment Productions using SMEs methodology. R.K. Bhalaji et al. (2018) Analyse the environmental health and risk factors in health care industries using the Fuzzy Decision Making approaches. Rahman et al, published paper on “Musculoskeletal symptoms and ergonomic hazards among material handlers in grocery retail industries”. He mentioned that the marketplace retail work is often physically demanding as crucial handlers' tasks concern practice lifting, movement, carrying, propulsion and pulling loads, fibre of this learning puts them at risk for real low hindermost some thesis, nearthrosis, feeling and deciding contractile wind injuries. They were conducted by the mistreatment of 2 differing kinds of tools that were Nordic contractile articulator constituted (NMQ) as an examination and the General Manual Hit and Wellbeing Act (WISHA) organisation as a good in discipline hazards.

The ergonomic hazard includes  
Improperly adjusted chairs.  
Frequent lifting.  
Poor posture.  
Repetitive, awkward movements.  
System and computer program.  
Workstation design and height.  
Equipment layout and operation

Table 2 shows the number of ergonomic hazards faced in the last year. Through this data, we can identify where the ergonomic hazards occur severely. Pareto Analysis is a technique used in decision-making based on the 80/20 rule. It is based on the idea that 80% of a project's benefit can be achieved by doing 20% of the work, or conversely 80% of problems are traced to 20% of the causes.

By using the previous year's total number of ergonomic hazards, the high-risk ergonomic hazard department has been analysed by Pareto analysis in this research paper; only those departments are focusing on terms of ergonomic hazards.

Table 2. Count of ergonomic hazards by department

S.No	Department	Number of hazards
1	Canteen	27
2	Cheese dyeing	21
3	Hank dyeing	13
4	Engineering	9
5	Stores & Purchase	7
6	Logistics	5

Figure 2 shows that up to 74% of ergonomic hazards have occurred in the canteen, cheese dyeing and hank dyeing departments in the industry. Rather than focusing on all the departments, by analysing these three departments, the ergonomic risk factor can be reduced.

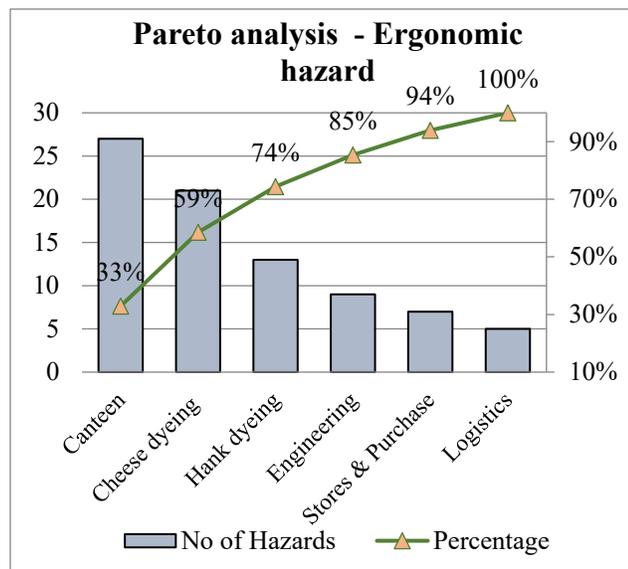


Figure 2. Pareto analysis of high-risk department

#### 4.2 Hazards in various Departments:

Table 3 shows some of the tasks which cause discomfort for the employee. These are some possible ergonomic hazards identified by the ergonomic survey, and the employees are investigated after finishing the work.

Table 3. Representative ergonomic hazards and task descriptions by department

Department	Description
Canteen	A worker repetitively serving the food by bending in an awkward posture.
	Workers are standing for nearly 5 hours to make food & serve.
	Employers who are cleaning the vessels by standing and bending for a long time.
Cheese dyeing	Repetitively, the workers stretch & bend their bodies to take out the cheese carrier.
	Workers are putting more force to push the cheese carrier.
Hank dyeing	In a boni vehicle, due to the heavy weight, the wheels are tilting on one side, so the workers are giving more force to push.

Table 4 shows the PART A risk score by analysing the observed tasks using the WERA tool in terms of shoulder, wrist, neck, back and leg. Table 5 shows the PART B risk score by analysing the observed tasks in terms of force, vibration, stress and job duration.

Table 4. PART A — WERA posture scores by department (shoulder, wrist, neck, back, leg)

Department	Shoulder	Wrist	Neck	Back	Leg	Part-A
Canteen	5	0	5	4	3	17
	5	3	5	5	6	24
	5	3	6	5	6	25
Cheese dyeing	5	2	5	4	6	22
	5	0	4	5	3	17
Hank dyeing	2	3	5	5	4	19

Table 5. PART B — WERA physical factor scores by department (stress, vibration, force, duration)

Department	Stress	Vibration	Force	Duration	Part-B
Canteen	3	2	4	6	15
	3	2	5	6	16
	4	2	5	6	17
Cheese dyeing	3	2	6	6	17
	3	2	6	5	16
Hank dyeing	2	2	5	6	15

Table 6. Combined WERA scores and risk level before recommendations (Part A + Part B = Total)

Department	Part A	Part B	Total	Level
Canteen	17	15	32	Medium
	24	16	40	
	25	17	40	
Cheese	22	17	34	
Dyeing	17	16	34	
Hank dyeing	19	15	34	

Table 6 shows that all the tasks fall under the risk score of 28 to 44. So, the tasks are temporarily acceptable, but they need to investigate further improvement so that the employee will not feel discomfort while doing the work. If the work/task continues for a long period, indeed, the employee will be affected by the MSD problem. The above risk scores are the risk factors sophisticated by the employee.

Therefore, in the above WERA analysis Tool, the PART A and PART B values play an important role in evaluating the risk scores from the worker's performance and Physical tasks observed from the various operations carried out inside the Canteen, Cheese dying and Hank dyeing locations. In this WERA Tool, PART A represents the postures and repetition encountered based on the worker's performance and actions, while PART B represents the physical factors or causes of the postures and repetition. As per the WERA standards referred to, the scores should not be above the range of 28. So, it is considered a medium level of risk present in the above three locations. Even though it is a medium-level task, the task should be improved.

## 5. Results and discussion

Manual material handling is one of the dangerous tasks in the workplace. The high ergonomic issues may affect the person who does such work. From the different manual handling, the Lifting and lowering of an object is the main task that includes high risk. During the manual lifting and lowering of an object, we should be careful to follow some instructions such as Avoid unnecessary bending, Keep the trunk and neck be straight, Avoid twisting, Keep the feet touch the floor properly, Avoid the stretching of hand and leg, Lift the weight maximum to the shoulder level, Keep the hand is closer to the leg position while lifting and also have to maintain a good working posture. Based on the outcomes of each score, it is decided to implement the risk reduction techniques by using continuous monitoring and administering controls.

### 5.1. Recommendations

#### a) Shoulder and Neck:

The highest score of the WERA assessment in the physical risk was neck and shoulder. The workstation or working environment should be redesigned to reduce the WERA score. Figure 3 shows, in the cheese dyeing Department DPL area, the operator and the employee stretch over to the object due to the very high height to take down the cheeses from the DPL. This causes the physical risk, and the WERA score becomes high because of the neck and shoulder bending. By installing the table with a height of 120cm, a width of 60cm and a length of 60cm, the employee can stand on the table while taking out the cheese from the carrier. Neck pain is a typical issue for young people, and posture has been proposed as a significant risk factor. Unhealthy working postures at the storage compartment, neck, and shoulders might be brought about by various components, including workstation format, the structure of hardware and instruments, and work strategies. By chance that arm and wrist supports are powerful, they may be useful as preventive measures to diminish the take an enormous risk of shoulder problems.



Figure 3. The employee stretched to take the cheeses from the carrier.

b) Leg:

Another issue existing in this activity was the standing movement performed for quite a while. Leg stacking in employees can be critical during the sit-to-stand move in correlation with simply standing and walking. Starting hip flexion was more noteworthy for controls, and beginning knee flexion was more prominent for patients, showing that patients utilised a leg lift to a greater degree. Causing is to sit and stand up in a structured work environment was far-fetched because the organisation's work methods required the employees/administrators to remain at work and could sit or enjoy a rest during the reprieve time. Even though this sort of progress could not diminish the WERA score, it was normal. This could make the administrators feel agreeable in working. Figure 4 shows that in the canteen department preparation area, the employees are standing for more than 3 hrs to make the food.



Figure 4. Employees standing for more than 3 hours to make the food

c) Back:

The relationship may exist between utilised spinal postures, physical latency, and low back pain in employees with a report of flexion strain injury and flexion pain incitement. The expanded danger of low back pain was related to the increased recurrence of back pain when doing manual tasks. Figure 5 shows that while cleaning the vessel in the canteen department, the employee wants to bend their back for cleaning the vessel for a long time. Instead of placing a table of 120cm length, 90cm height, and 120 cm width, the employees do not need to bend over hereafter, and also by placing the chair, the employee will not feel the pain in their back and legs.



Figure 5. Employees spend more than 1 hour cleaning the vessel

d) Force:

The manual lifting was viewed as a significant hazard factor for the occurrence of lower-back pain. By distributing the load, it tends to be lifted close to the body (each hand will have one weight), rather than before the body, which is expected to reduce the low-back burden. While lifting an unevenly adjusted burden, a two-person lift appears to receive a lifting methodology that partially eases the bigger spinal burdens experienced by the colleague at the heavier end of the heap. Lifting a 25-kg split load rather than a 25-kg single load resulted in most cases in a decrease in the peak. Avoidance of work-related low back pain during periods of mechanical change ought to include workers in the planning and execution. Figure 6 shows that in the cheese dyeing department DPL area, the employees put more force to push the cheese carrier vehicle. The cheese carrier vehicle contains 180 cheeses, and each cheese has nearly 300 grams of weight.



Figure 6. Employee putting more force to push the boni vehicle

e) Task Duration:

The time duration of a task is a hazard factor for WMSDs of the back, shoulder/arm, hand/wrist, and neck. The connections between physiological reaction sizes, conduct execution measures, and enactment during a continuous execution task. The OSHA ergonomic standard (2000) has characterised over 2 consecutive hours for every workday as essential in combination with other hazard factors. When day-by-day, time surpasses 4 hours, the pace of WMSDs increases in the back and shoulder/neck, particularly in the seating task. These are the recommendations proposed for the above task, reducing the WERA score and improving the workstation.

Table 7. Combined WERA scores and risk level after recommendations (Part A + Part B = Total)

Department	Part A	Part B	Total	Level
Canteen	11	8	19	Low
	13	8	21	
	13	9	22	
Cheese	9	9	17	
Dyeing	9	9	18	
Hank dyeing	10	9	19	

These are the recommendations proposed for the above task, reducing the WERA score and improving the workstation. Table 7 shows that the risk score for the various tasks is reduced by implementing the recommendations. The total risk scores lie in-between 18 to 27. So the tasks are acceptable, and there will be no ergonomic problem until the scores rise.

From this assessment of ergonomic working postures, activities represent the various benefits for the working organisations, such as ergonomic intervention, identification of awkward working postures, money, time, and improved quality, efficiency, worker spirit and makes better security culture. Fundamentally, representatives will perceive the ergonomic hazard elements and respond to limit such dangers.

## 6. Conclusion

This work is focused on the assessment of ergonomic risk factors by using the Workplace Ergonomic Risk Assessment tool and was conducted in the thread manufacturing industry. The WERA assessment has covered all the physical risk factors such as force, stress, vibration, and task duration. Furthermore, these physical risk factors affect the five major parts of the body, such as the shoulder, wrist, neck, back, and leg, which have been described as connected with work-related musculoskeletal disorders (WMSDs). Compared to the female employees, the male employees have to put a lot of force and more energy into doing the job, and they are getting injured. Within a first legitimacy trial, the correlation of separate WERA body part scores to the progress of pain or inconvenience is factually critical for the wrist, shoulder, neck, and back areas. The WERA tool is relatively easy to use; it does not require any special equipment or techniques. By observation and questionnaire survey of feedback, it is enough as an input for the WERA assessment, and it can be done in any workplace without interruption to the job that is going to be observed. Therefore, it shows that the WERA assessment will contribute a good suggestion for work-related musculoskeletal disorders, which may be reported as pain, ache, or inconvenience to the relevant employee.

The assessment can be extended by using the innovative technology that could more elaborately assess all awkward postures present in the workplace. The Maynard Operation Sequence Technique (MOST) can be used to improve ergonomic intervention practices in the workplace. The technique is designed to evaluate all the operational sequence postures in each unit of the workers. This work has a wide area of scope to improve ergonomics intervention practices by applying the MOST Technique. The recommended therapies led to measurable improvements in WERA ratings for each activity that was observed. For the six activities that were observed, the overall WERA scores dropped from 214 (before treatments) to 116 (post-interventions), a net decrease of 98 points, or around 45.8%. With task-level reductions ranging from 40.6% to 50.0%, all observed tasks shifted from the Medium risk group (28–44) into the Low/near-Low risk category ( $\leq 27$ ) following the implementation of the suggestions. These numerical improvements demonstrate the effectiveness of the treatments in lowering ergonomic risk based on exposure and posture, including workstation height change, chair availability, task reorganisation, load distribution, and short work breaks. Publication of genuine workstation photos is prohibited per industrial policy. Consequently, comprehensive explanations are offered to show the ergonomic adjustments that have been put into practice. We recommend a follow-up evaluation after six to twelve months to verify ongoing risk reduction and look for a drop in self-reported pain or MSD occurrence.

## References

- Bhalaji, R. K. A., A fuzzy decision-making trial and evaluation laboratory approach to analyse risk factors related to environmental health and safety aspects in the healthcare industry, *Sādhanā*, Vol. 44, No. 3, Article 55, 2019.
- Das, S., Analysis of musculoskeletal disorder risk in cotton/garment workers, *Journal of Industrial Ergonomics*, 2023.
- Felekoglu, B., and Ozmehmet Tasan, S., Interactive ergonomic risk mapping: A practical approach for visual management of workplace ergonomics, *International Journal of Occupational Safety and Ergonomics*, pp. 1–41, 2020.
- İmamoğlu, G., Ergonomic risk analysis of working postures for a textile factory worker, Case study / conference paper, 2024.
- Jaffar, N., Abdul-Tharim, A. H., Mohd-Kamar, I. F., and Lop, N. S., A literature review of ergonomics risk factors in construction industry, *Procedia Engineering*, Vol. 20, pp. 89–97, 2011.
- Karuppiah, K., et al., Role of ergonomic factors affecting production of leather garment-based SMEs of India: Implications for social sustainability, *Symmetry*, Vol. 12, No. 9, Article 1414, 2020.
- Koppihraj, K., Bathrinath, S., and Saravanasankar, S., A fuzzy VIKOR approach for selection of ergonomic assessment method, *Materials Today: Proceedings*, 2020.
- Liu, H.-C., Cheng, Y., and Ho, J.-J., Associations of ergonomic and psychosocial work hazards with musculoskeletal disorders of specific body parts: A study of general employees in Taiwan, *International Journal of Industrial Ergonomics*, Vol. 76, Article 102935, 2020.
- Mukund, A., Amanprasad, B. H., Rajeswara Rao, K. V. S., and Subramanya, K. N., Ergonomic evaluation of the work stations in a garment manufacturing industry—An exploratory study, *International Journal of Mechanical and Production Engineering*, Vol. 2, No. 4, 2014.
- Mufti, D., Ikhsan, A., and Putri, T. M., Workplace ergonomic risk assessment toward small-scale household business, *IOP Conference Series: Materials Science and Engineering*, Vol. 528, No. 1, Article 012013, 2019.
- Muthukrishnan, R., and Ahmad, J. M., Ergonomic risk factors and risk exposure level of nursing tasks: Association with work-related musculoskeletal disorders in nurses, *European Journal of Physiotherapy*, pp. 1–6, 2020.
- Rahman, M. N. A., and Zuhaidi, M. F. A., Musculoskeletal symptoms and ergonomic hazards among material handlers in grocery retail industries, *IOP Conference Series: Materials Science and Engineering*, Vol. 226, No. 1, Article 012027, 2017.
- Rahman, M. N. A., Rani, M. R. A., and Rohani, J. M., WERA: An observational tool developed to investigate the physical risk factors associated with WMSDs, *Journal of Human Ergology*, Vol. 40, No. 1–2, pp. 19–36, 2011.
- Rajakarunakaran, S., Kumar, A. M., and Prabhu, V. A., Applications of fuzzy fault tree analysis and expert elicitation for evaluation of risks in LPG refuelling station, *Journal of Loss Prevention in the Process Industries*, Vol. 33, pp. 109–123, 2015.
- Ray, P. K., Parida, R., and Saha, E., Status survey of occupational risk factors of manual material handling tasks at a construction site in India, *Procedia Manufacturing*, Vol. 3, pp. 6579–6586, 2015.
- Santos, W., Efficacy of ergonomic interventions on work-related musculoskeletal disorders: Systematic review, *Journal of Clinical Medicine*, 2025.
- Selki, H. M., A literature review of ergonomics programs, *Proceedings of the 3rd International Engineering Conference on Developments in Civil & Computer Engineering Applications*, p. 191, 2017.
- Sugiono, Sugiono, Efranto, R. Y., and Budiprasetya, A. R., Reducing musculoskeletal disorder risk of wiring harness workstation using WERA method, *Przegląd Naukowy Inżynieria i Kształtowanie Środowiska*, Vol. 27, No. 4, 2018.
- Yang, S. T., Park, M. H., and Jeong, B. Y., Types of manual materials handling and occupational incidents and musculoskeletal disorders in the motor vehicle parts manufacturing industry, *International Journal of Industrial Ergonomics*, Vol. 77, Article 102954, 2020.

## Biographies

**Balaji R** is a student pursuing M.Tech Industrial Safety Engineering at Kalasalingam Academy of Research and Education, Krishnankoil, Srivilliputhur, Tamil Nadu. He completed his undergraduate degree in Civil Engineering at National Engineering College, Kovilpatti, Tamil Nadu.

**Rajpradeesh T** is a faculty member working as an assistant professor in the Department of Mechanical Engineering at Kalasalingam Academy of Research and Education, Krishnankoil, Srivilliputhur, Tamil Nadu. His research domains are Fire Engineering, Human Factors, Ergonomics and Healthcare Management Systems. He published twenty

*Proceedings of the 5<sup>th</sup> Indian International Conference on Industrial Engineering and Operations Management, Vellore, Tamil Nadu, India, November 6-8, 2025*

research articles and was indexed in the Scopus database. He completed under degree in Electrical and Electronics Engineering and his postgraduate degree in Industrial Safety Engineering.