Publisher
Vandana Publications
www.vandanapublications.com

International Journal of Engineering and Management Research

2026 Volume 16 Number 1 February

E-ISSN:2250-0758
P-ISSN:2394-6962

Research Article

Ergonomics

Ergonomic Postural Risk Monitoring of Worker Working on Lathe Machine

A.M. Kakde[1*], S.M. Kherde[2]

DOI:10.31033/IJEMR/16.1.2026.1836

[1*] A.M. Kakde, Research Scholar, Department of Mechanical Engineering, Sipna College of Engineering and Technology, Amravati, Maharashtra, India.

[2] S.M. Kherde, Principal, Sipna College of Engineering and Technology, Amravati, Maharashtra, India.

The operation of lathe machines in manufacturing industries often exposes workers to awkward postures, repetitive motions, and prolonged static positions that may contribute to musculoskeletal disorders (MSDs) and reduced productivity. Ergonomic assessment and monitoring of postural risks are therefore essential to ensure worker safety, efficiency, and overall well-being. This study focuses on the ergonomic postural risk monitoring of workers operating lathe machines using observational methods and posture evaluation tools such as RULA (Rapid Upper Limb Assessment) and REBA (Rapid Entire Body Assessment). The analysis highlights high-risk postures associated with bending, twisting, and extended arm reach during machining, loading, and unloading tasks. Data collected were further examined to identify critical risk zones and propose corrective ergonomic interventions such as workstation redesign, tool placement optimization, and work-rest scheduling. The findings indicate that ergonomic interventions not only minimize postural risks but also enhance operator comfort, reduce fatigue, and improve productivity. This study emphasizes the importance of integrating ergonomic monitoring systems into machine shop environments for sustainable industrial practices.

Keywords: Ergonomics, Postural Risk, Musculoskeletal Disorders (MSDs), RULA (Rapid Upper Limb Assessment), REBA (Rapid Entire Body Assessment), Fatigue Reduction

Corresponding Author

A.M. Kakde, Research Scholar, Department of Mechanical Engineering, Sipna College of Engineering and Technology, Amravati, Maharashtra, India.
Email: apoorvai77@gmail.com

How to Cite this Article

A.M. Kakde, S.M. Kherde, Ergonomic Postural Risk Monitoring of Worker Working on Lathe Machine. Int J Engg Mgmt Res. 2026;16(1):11-15.
Available From
https://ijemr.vandanapublications.com/index.php/j/article/view/1836

To Browse

Manuscript Received	Review Round 1	Review Round 2	Review Round 3	Accepted
2026-01-02	2026-01-17			2026-02-02

Conflict of Interest	Funding	Ethical Approval	Plagiarism X-checker	Note
None	Nil	Yes	5.43	

1. Introduction

In modern manufacturing industries, lathe machines play a vital role in shaping and machining metal components with precision. However, operating a lathe machine involves repetitive motions, awkward body postures, static loading, and continuous visual focus, which may expose workers to significant ergonomic risks. Prolonged exposure to these factors can result in musculoskeletal disorders (MSDs), fatigue, reduced efficiency, and long-term occupational health issues. According to ergonomic studies, poor working posture is one of the major contributors to decreased worker performance and increased risk of work-related injuries. Ergonomic postural risk monitoring provides a systematic approach to evaluate the stresses and strains experienced by workers during machine operations. Tools such as RULA (Rapid Upper Limb Assessment), REBA (Rapid Entire Body Assessment), and OWAS (Ovako Working Posture Analysis System) are widely applied to identify high-risk postures in industrial operations. These methods help in quantifying postural load, identifyingunsafe work practices, and suggesting corrective measures for improving workplace safety.

In the lathe machine operations, workers are often required to bend, twist, stretch, or maintain prolonged standing positions while performing machining, measuring, or material handling tasks. Such postures not only affect physical health but also compromise concentration and productivity. Therefore, ergonomic interventions such as workstation redesign, tool placement optimization, use of supportive equipment, and implementation of work-rest cycles are essential to minimize risks and enhance worker comfort.

The present study aims to monitor and analyze the ergonomic postural risks associated with lathe machine operations. By applying observational assessment methods and identifying critical postural hazards, the research seeks to propose effective ergonomic solutions that can improve occupational health, safety, and productivity in lathe machine operations.

2. Objectives of the Study

A. To evaluate the working postures of lathe machine operators during various machining tasks using ergonomic assessment tools such as RULA, REBA, and OWAS.
B. To identify high-risk postures that may contribute to musculoskeletal disorders (MSDs) and occupational health problems.
C. To analyze the relationship between postural risk factors, worker fatigue, and productivity in lathe machine operations.
D. To propose ergonomic interventions such as workstation redesign, tool placement optimization, and work-rest scheduling for reducing postural risks.
E. To recommend practical guidelines for improving worker safety, comfort, and efficiency in machine shop environments.

3. General Principles of Ergonomics

Ergonomics principles can be described as interaction between human- machine systems. It consists of three main components that interact with each other. These components are human components, machine components and the environment. In ergonomics criteria the interaction between human bodies to its surround should be optimized. The physical space requirements should be met (anthropometry data) and internal, external forces that exerted on the body are not harmful. Human components to the work system can be divided in three segments, which are the effectors, the senses and supportive processes. Human interaction with machines depends on the provision of suitable controls which can be acted on by the effectors. Workspace is the three- dimensional space in which work is carried out. Workspaces usually fixed which introduces design issues such as the need to determine the workspace dimensions. This requires the dimension of the machine, anthropometry, and activities required by both man andmachine to carry the task to be considered.

Table I: Ergonomic Recommendations for Lathe Machine Operators

Aspect	Recommended Dimensions / Guidelines	Remarks (Human Factors Consideration)
Work surface height (machining tasks)	5–10 cm below worker's elbow height (≈ 95–105 cm for average adult male)	Reduces shoulder and upper arm strain; allows precision without excessive bending.
Work surface height (heavy tasks – loading/unloading)	70–90 cm	Lower height reduces lifting effort and trunk bending.
Optimal reach zone (frequent use)	Within 40–50 cm from the worker's body	Prevents overreaching and twisting of trunk.
Maximum reach zone (occasional use)	Up to 70–80 cm from the worker's body	Should only be used for infrequent operations.
Standing clearance (leg space)	≥ 10–15 cm toe clearance at machine base	Prevents forward leaning and provides stable standing posture.
Control panel / switches height	90–120 cm from floor	Allows easy access without excessive bending or stretching.
Tool and material storage height	Frequently used tools: 80–120 cm; Rarely used tools: up to 150 cm	Keeps tools in safe reach zones to minimize fatigue.
Visual display / workpiece eye level	100–120 cm (slightly below horizontal eye level)	Prevents excessive neck bending while monitoring machining.
Standing duration	Not more than 2 hours continuously	Encourage micro- breaks or task variation to reduce fatigue.
Flooring / standing support	Anti-fatigue mats, supportive shoes	Reduces discomfort in lower limbs and back.
Work surface height (machining tasks)	5–10 cm below worker's elbow height (≈ 95–105 cm for average adult male)	Reduces shoulder and upper arm strain; allows precision without excessive bending.

4. Ergonomics of Standing Workers on Lathe Machine

Operating a lathe machine typically requires the worker to remain in a standing position for prolonged periods. While standing allows mobility and access to the machine's working area, it also poses several ergonomic challenges if not properly managed.

The main ergonomic considerations for standing workers at a lathe machine include posture, body movement, reach, and fatigue management. Workers often bend forward to observe the work piece closely, causing strain on the neck, shoulders, and lower back. Prolonged standing without support increases static load on the legs and spine. Frequent twisting of the trunk and stretching of arms while adjusting tools or loading/unloading components contributes to musculoskeletal strain.

Tools, measuring instruments, and controls should be placed within the worker's primary reach zone to avoid excessive leaning and stretching. The optimal working height is generally 5–10 cm below elbow height to reduce upper limb fatigue. Poor layout of tools and accessories forces workers to adopt awkward postures, increasing ergonomic risks. Prolonged standing without movement can cause discomfort, swelling in legs, and reduced blood circulation. Repetitive tasks and static postures increase the risk of musculoskeletal disorders (MSDs), particularly in the back, neck, shoulders, and knees.

Provide anti-fatigue mats or supportive footwear to reduce strain on the lower limbs. Ensure the lathe machine is adjusted to an appropriate height relative to the worker's stature. Introduce adjustable work platforms for workers of different heights. Arrange tools, controls, and measuring devices within easy reach to minimize bending and stretching. Encourage micro- breaks and posture variation to reduce fatigue. Training workers in proper body mechanics and posture awareness.

5. Methodology and Description of Operation

The study was carried out in a machine shop environment where workers were observed while performing routine lathe machine operations. An observational ergonomic assessment approach was adopted to evaluate postural risks using standard ergonomic tools such as RULA (Rapid Upper Limb Assessment), REBA (Rapid Entire Body Assessment).The study involved lathe machine operators with at least 2–5 years of experience. Anthropometric measurements such as stature, elbow height, and arm reach were recorded to compare with recommended ergonomic standards.

A. Description of Operation

In Lathe machine operation workers perform various operations such as load and clamp of raw material into the chuck, turning, facing, threading, and finishing operations, requiring continuous monitoring ofthe cutting process. Frequent tool changes, measurement with gauges, and repositioning of work piece. Removing the finished work piece and performing dimensional checks. During these activities, workers typically stand in front of the machine, often bending forward, twisting the trunk, stretching arms to reach tools, or maintaining static postures for long durations. These postures were considered for ergonomic evaluation.

Figure1: Working Posture of worker on lathe machine

B. Data Collection Methods

- *Direct Observation:* Postures of workers were recorded during each phase of lathe operation.
- *Photography & Video Recording:* Used to capture body angles, bending, and repetitive actions for later ergonomic assessment.
- *Anthropometric Data Comparison:* Machine and workstation dimensions were compared with ergonomic standards.

C. Ergonomic Assessment Tools

- *RULA:* Focused on upper limb risks during fine machining tasks.
- *REBA:* Evaluated whole-body postures during material handling and prolonged standing.

D. Data Analysis

Postural scores were calculated using each method. Risk levels were compared to identify tasks requiring immediate ergonomic intervention.

6. Results and Discussion

A. Anthropometric Findings

- Average standing height: 168 cm.
- Average elbow height: 105 cm.
- Recommended work surface height: ~95–100 cm.
- *Existing lathe machine height:* 115 cm → higher than optimal, causing shoulder elevation and neck strain.

B. Ergonomic Risk Scores

- *RULA:* Most machining tasks scored 5–6 (high risk, requiring change soon).
- *REBA:* Loading/unloading tasks scored 8–10 (very high risk, requiring immediate action).

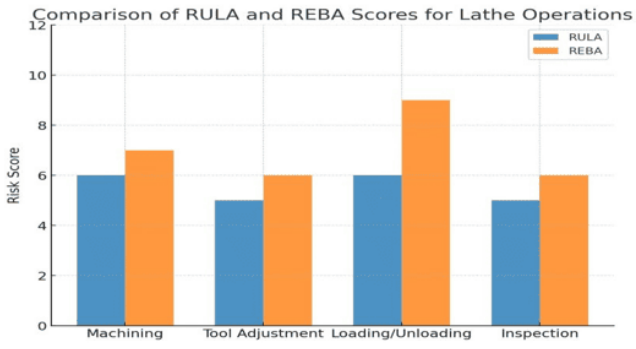
C. Identified High-Risk Postures

- Forward bending during close inspection of work piece.
- Twisting trunk while reaching for tools placed away from primary reach zone.
- Prolonged static standing without foot support.

D. Recommended Interventions

- Adjust lathe machine height to 95–100 cm (5–10 cm below elbow height).
- Relocate frequently used tools within 40–50 cm reach zone.
- Provide anti-fatigue mats and supportive footwear.
- Implement micro-breaks or job rotation to reduce fatigue.
- Train workers in posture awareness and safe handling techniques.

Figure 2: Comparison of RULA and REBA Scores for lathe Operations



7. Discussion

Findings confirm that poor workstation design and improper tool placement significantly increase postural risk. Ergonomic interventions can minimize MSD risks, enhance comfort, and maintain consistent productivity.

The integration of anthropometry ensures that machine dimensions align with worker body dimensions, making the workplace human-centered.

8. Conclusion

Ergonomic postural risk monitoring of lathe operators revealed significant risks associated with awkward postures, trunk bending, and prolonged standing. The application of RULA, REBA, and OWAS provided reliable risk scores, highlighting the need for immediate interventions. Adjusting workstation height, optimizing tool placement, and introducing supportive measures can substantially reduce postural stress and improve worker well-being. Most of the workers are unable to select their desirable and comfortable postures. The adoption of unhealthy postures is because of improper workstation design. This inconvenient posture may lead to musculoskeletal injuries and other symptoms. Therefore, the workstation can be redesigned using the ergonomic principles to accommodate individuals ranging from 5th percentile to 95th percentileIndian population.

It is found that assessment of comfort is a complex process due to involvement of large number of factors. However ergonomic evaluation provides the root cause analysis to find out the sites of discomfort. This study emphasizes the importance of incorporating ergonomics into machine shop environments to achieve both occupational health and productivity improvements.

References

[1] McAtamney, L., & Corlett, E. N. (1993). RULA: A survey method for the investigation of work-related upper limb disorders. *Applied Ergonomics*, *24*(2), 91–99.

[2] Hignett, & McAtamney, L. (2000). Rapid entire body assessment (REBA). *Applied Ergonomics*, *31*(2), 201–205.

[3] Karhu, O., Kansi, P., & Kuorinka, I. (1977). Correcting working postures in industry: A practical method for analysis. *Applied Ergonomics*, *8*(4), 199–201

[4] Bridger, R. S. (2018). *Introduction to human factors and ergonomics*. CRC Press.

[5] Asim Zaheer et al. (2012). Ergonomics: A work place realities in Pakistan. *International Posture Journal of Science & Technology, 2*(1).

[6] Krishnamoorthy Muthukumar et al. (2012). Discomfort analysis in computerized numeric control machine operations. *Saf Health Work, 3*, 146-53.

[7] Isa Halim et al. (2011). Posture, muscle activity and oxygen consumption Evaluations among metal stamping operators: A pilot studyin Malaysian small and medium industries. *Journal - The Institution of Engineers, Malaysia, 72*(4).

[8] Aman Sachdeva et al. (2011). Minimizing musculoskeletal disorders in lathe machine workers. *International Journal of Ergonomics, 1*(2).

[9] M.C.I. Javier Antonio, & Lom Holguín et al. (2008). *Ergonomics and its relationship to the design of production processes*. Ponencia Conergo.

[10] Mohammad Iqbal et al. (2011). Ergonomics and design. *International Conference on Industrial Engineering and Operations Management Kuala Lumpur, Malaysia*.

[11] L. P. Singh. (2010). Work posture assessment in forging industry: An exploratory study in INDIA. *International Journal of Advanced Engineering Technology, 1*(III).