

FACTORS INFLUENCING MUSCULOSKLETAL DISORDERS (MSDS) AMONG WORKSHOP WORKERS

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Abstract

Musculoskeletal Disorders (MSDs) represent a significant occupational health issue among workshop workers. Tasks such as bending, lifting heavy loads, and maintaining awkward body positions increase the risk of musculoskeletal strain. WHO (2023) reports that 60–70% of manual workers experience MSDs, and in Indonesia, the prevalence among workshop workers reaches 72–85%. Key risk factors include non-ergonomic postures, repetitive movements, long working hours, and exposure to poor environmental conditions. Given the high burden of MSDs, a systematic review is essential to identify contributing factors and guide preventive strategies. This study used a Systematic Literature Review (SLR) based on the PRISMA 2020 guidelines. The literature search was conducted in Google Scholar, Garuda Ristekbrin, ResearchGate, ScienceDirect, and PubMed, covering publications from 2015–2025. Keywords included "Musculoskeletal Disorders," "MSDs," "mechanic workshop," "ergonomic risk factors," "work posture," and "vibration." Articles were screened through four stages: identification, title and abstract screening, full-text eligibility assessment, and final inclusion. Only original research articles related to MSDs among workshop workers, written in Indonesian or English, and available in full text were included. From 240 identified articles, 20 met all criteria. A total of 20 studies with the inclusion criteria. The findings show that Musculoskeletal Disorders (MSDs) among workshop workers are influenced by three main categories of factors. First, individual factors such as age, length of employment, Body Mass Index (BMI), and exercise habits contribute to the increased risk of MSDs. Workers who are older, have long work experience, or have higher BMI tend to report more musculoskeletal complaints. MSDs among workshop workers are mainly caused by poor work posture, long working hours, and non-ergonomic conditions. Improving ergonomic practices and promoting safe work behaviors are essential to reducing these risks.

Keyword: Musculoskeletal Disorders, MSDs, mechanical workshop, ergonomic risk factors, work posture

INTRODUCTION

Musculoskeletal Disorders (MSDs) are complaints or disorders affecting the muscles, ligaments, joints, nerves, and bones that arise due to excessive physical activity, non-ergonomic work postures, and repetitive movements. Workshop workers are considered a high-risk group because they frequently perform activities such as bending, lifting heavy loads, and working in uncomfortable positions for prolonged periods. According to the World Health Organization (WHO, 2023), approximately 60–70% of manual workers in developing countries experience MSD complaints, particularly in the lower back, shoulders, and neck. In Indonesia, the prevalence of MSDs among workshop workers is reported to reach 72–85% (Puspita et al., 2017; Inayah, 2024).

Musculoskeletal disorders are one of the leading causes of lost workdays in the industrial sector (ILO, 2022). Studies by Danesh mandi et al. (2025) and Tamene et al. (2020) show that workshop workers have twice the risk of experiencing MSD complaints compared to administrative workers due to prolonged bending postures and repetitive movements. Several studies indicate that the main risk factors for MSDs include non-ergonomic work postures, long work duration, repetitive movements, heavy lifting, and extended working hours (Pratiwi et al., 2025; Satriyandhi et al., 2025). Individual factors such as age, body mass index (BMI), and exercise habits also influence the level of complaints (Linggi et al., 2024).

In addition, environmental factors such as machine vibration, high temperatures, and inadequate lighting may worsen the physical condition of workshop workers. Working conditions in workshops generally do not adhere to ergonomic principles. Most workshops in Indonesia operate informally and lack adequate occupational safety standards.

Limited ergonomic training and the absence of supportive work facilities, such as worktables adjusted to body height or lifting assistance tools, further increase the risk of musculoskeletal injuries. Findings by Saikhunuddin et al. (2024) show that REBA and RULA scores among workshop workers frequently fall into the high to very high-risk categories, indicating an urgent need for corrective actions. MSDs not only reduce work productivity but also lead to increased absenteeism, decreased performance, and higher medical costs. Therefore, a systematic review of the factors influencing MSD occurrences among workshop workers is essential to formulate comprehensive and ergonomics-based prevention strategies.

RESEARCH METHODS

This study used a Systematic Literature Review (SLR) design to systematically examine research findings related to the factors influencing Musculoskeletal Disorders (MSDs) among workshop workers. This approach followed the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and replicability in the literature search and selection process. Article searches were conducted online through five databases: Google Scholar, Garuda Ristekbrin, ResearchGate, ScienceDirect, and PubMed, covering publications from 2015–2025. The keywords used included: "Musculoskeletal Disorders" OR "MSDs" AND "workshop workers" OR "mechanic workshop" AND "ergonomic risk factors" OR "work posture" OR "length of employment" OR "vibration". The retrieved articles were screened according to inclusion and exclusion criteria. The inclusion criteria consisted of original research articles discussing MSDs among workshop workers or similar occupations, having a clear research methodology, written in Indonesian or English, and available in full text. Articles that were irrelevant, duplicated, or lacking quantitative data were excluded from the analysis. The literature selection process followed the four PRISMA stages:

1. Identification, yielding 240 articles from the five databases.
2. Screening, selecting 90 articles based on title and abstract.
3. Eligibility, evaluating 45 articles in full text and excluding 25 that did not meet methodological requirements.
4. Inclusion, resulting in 20 articles that were further analyzed. Data analysis was conducted thematically and descriptively by reviewing key variables associated with MSDs.
5. These variables were grouped into three main categories:
6. Individual factors: age, length of employment, gender, body mass index (BMI), and exercise habits.

Occupational factors: work posture, working duration, repetitive movements, and lifting load. Environment factors: machine vibration, temperature, lighting, and workplace ventilation. All articles that met the inclusion criteria were reviewed to identify consistent patterns across studies. The synthesized findings were then used to determine the dominant factors contributing to MSDs and to formulate ergonomics-based prevention strategies applicable to the workshop sector in Indonesia.

Journal selection using the flowchart method.

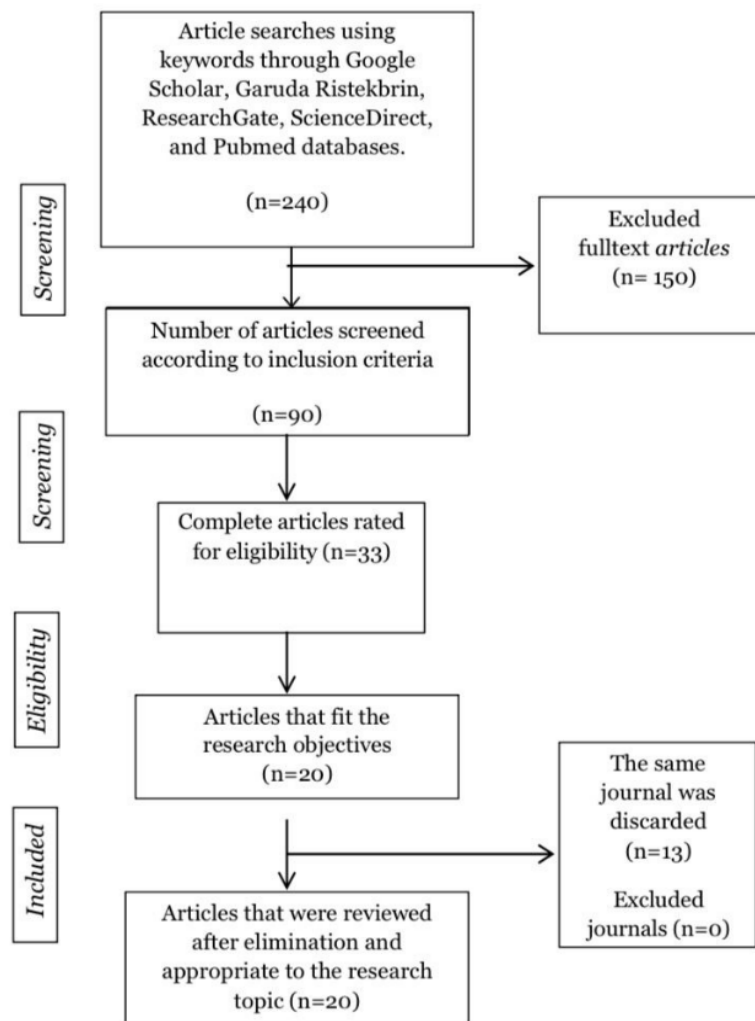


Figure 1. PRISMA Flowchart

RESEARCH RESULTS

The results of the literature review were carried out on 20 articles that met the inclusion criteria based on the PRISMA 2020 guidelines. The articles analyzed are derived from national and international research in the period 2015–2025, with a primary focus on the identification of risk factors for Musculoskeletal Disorders (MSDs) in workshop workers and similar physical occupations. The literature search process yielded a total of 240 articles from five scientific databases. After the screening process and methodological feasibility assessment, as many as 20 articles were selected for further analysis. The analysis was carried out by extracting information about the author, year, research location, research design, number of samples, instruments used, and key results. The findings show that Musculoskeletal Disorders (MSDs) among workshop workers are influenced by three main categories of factors. First, individual factors such as age, length of employment, Body Mass Index (BMI), and exercise habits contribute to the increased risk of MSDs. Workers who are older, have long work experience, or have higher BMI tend to report more musculoskeletal complaints.

Table 1. The Following Are Selected Articles Analyzed

NO	Authors & Year	Article Title	Research Method	Instrumens	Research Findings
1	Pratiwi et al., 2025	The Relationship Between Work Tenure and Work Posture with MSDs among Automotive Mechanics	Cross- sectional	REBA, NBM	Work tenure ($p=0.048$) and posture ($p=0.005$) significantly related to MSDs. Longer work duration and poor posture increase MSD risk.
2	Daneshmandi et al., 2025	Assessing Cumulative Musculoskeletal Strain in Automotive Mechanics	Cross- sectional	P-CMDQ, LiFFT, SWAT, DUET	High discomfort in lower back (42%), shoulders (40%). Strong correlation between cumulative workload and MSDs.
3	Hosseini et al., 2025	Prevalence and Multivariate Analysis of MSD Risk Factors Among Automotive Assembly Workers	Cross- sectional	ASA-TLX, SMET, NMQ	Highest MSD prevalence in neck & lower back (44%). Influenced by poor posture, high mental workload, smoking, health history.
4	Satriyandhi et al., 2025	Musculoskeletal Risk Assessment in Manual Handling Activities at Sidomulyo Auto Workshop	Qualitative	REBA, NBM	REBA score >9 (very high risk). Immediate corrective action needed for lifting activities.
5	Inayah et al., 2024	Risk Factors of MSDs Among Auto Workshop Workers in Kebomas District	Cross- sectional	NBM	Age and work tenure significant ($p<0.05$). Senior workers experience more moderate-high MSD complaints.
6	Linggi et al., 2024	Factors Associated with MSDs Among Workers at PT X	Cross- sectional	REBA, NBM	Age, work tenure, and Posture significant. Non ergonomic posture $\rightarrow$ 74% severe complaints.
7	Anggraini et al., 2024	Ergonomic Risk Factors Associated with MSDs Among Weaving Workers	Cross- sectional	REBA, NBM, Lactate Test	Posture and fatigue strongly related to MSDs. Most complaints in lower neck (66%) and left shoulder

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NO	Authors & Year	Article Title	Research Method	Instrumens	Research Findings
					(53%).
8	Saikhunuddin et al., 2024	Work Posture and MSD Complaints Amon Steel Industry Workers	Observation al	REBA, NBM	4 high-risk and 2 very high-risk workers. 87% report moderate MSDs. Squatting and bending are most harmful.
9	Ilham Adelino et al., 2023	Posture Analysis Using RULA and REBA at Aryka Motor Workshop	Observation al	RULA	All workers in high-risk category. Worktable redesign required.
10	Fajri & Modjo, 2023	Physical & Individual Factors Related to MSD Prevalence in Auto Workshop Employees	Cross- sectional	QEC, NBM	BMI & exercise habits significant. Main complaints: waist (65%), back (63%).
11	Prasetyo et al., 2023	Determinants MSDs Complaints Among Welding Workers	Cross- sectional	NBM	Age, work tenure, workload, and work posture significantly related to MSDs.
12	Yang et al., 2023	Prevalence and Risk Factors of WMSDs Among Electronics Manufacturing Workers in China	Cross- sectional	NMQ	WMSDs prevalence 40%. Neck (26%) & shoulder (22%) most common. Risks: repetition, heavy loads, prolonged sitting, cold temperature
13	Patel et al., 2023	Work-Related Musculoskeletal Pain Among Garage Workers in Bharuch District	Cross- sectional	NBM	80% experienced MSDs. Highest complaints: lower back (39%).
14	Masrudin et al., 2022	Ergonomic Risk and MSD Complaints Among Seismic Oil Workers	Cross- sectional	REBA, NBM	Most activities rated high– very high risk. Common complaints: back, waist, wrists.
15	Onawumi et al., 2022	Combined Occupational Hazards Among Automobile Repair Workers in Nigeria	Cross- sectional	MSD Questionnaire	BMI, environment, and lifting >23 kg significantly related to MSDs.
16	Suryanto et al., 2020	Ergonomic Risk and MSD Complaints Among Informal Welding Workers	Cross- sectional	REBA, NBM	Ergonomic risk & age significant. 56% of workers at risk of MSDs.

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NO	Authors & Year	Article Title	Research Method	Instrumens	Research Findings
17	Tamene et al., 2020	MSDs and Associated Factors Among Vehicle Repair Workers in Hawassa, Ethiopia	Cross- sectional	NMQ-E	MSD prevalence 47%. Repetition → 4× risk. Lifting >20 kg → 4.8× risk.
18	Puspita et al., 2017	Work Posture Analysis and MSD Complaints Among Motorcycle Mechanics	Qualitative	BRIEF Survey	49% of postures are high risk. Complaints: back, shoulders, hands.
19	Kharisma & Putra, 2016	MSD Analysis in XYZ Workshop Workers Using RULA	Observation al	RULA, NBM	Two postures require immediate correction. Most complaints occur in upper neck.
20	Anyaeche & Ishie, 2016	Ergonomic Risk Factors in Auto- Repair Shops	Descriptive Observation al	REBA, NMQ	Majority of workers in high–very high risk. Complaints: lower back, neck, shoulders, wrists.

Based on the results of the thematic analysis, it was found that the risk factors for MSDs are divided into three broad categories: individual factors, occupational factors, and environmental factors.

1. Individual factors include age, working age, body mass index (BMI), exercise habits, and lifestyle. Several studies such as Inayah et al. (2024) and Prasetyo et al. (2023) show that workers with older age, long working hours, and high BMI have a greater risk of developing musculoskeletal complaints, especially in the shoulders, back, and waist. On the contrary, regular exercise habits have been shown to reduce the rate of MSDs complaints (Fajri & Modjo, 2023).
2. Occupational factors are the most dominant cause of the incidence of MSDs. Unergonomic work postures, repetitive movements, long work duration, and heavy lifting loads are consistently found to be the main factors (Pratiwi et al., 2025; Daneshmandi et al., 2025; Satriyandhi et al., 2025). REBA and RULA values in most studies indicated high to very high risk categories (>9), indicating the need for immediate intervention on workplace posture and layout.
3. Environmental factors such as engine vibration, hot temperature, and inadequate lighting also have a significant effect on the complaints of MSDs. Research by Saikhunuddin et al. (2024) and Linggi et al. (2024) revealed that chronic vibration exposure and low lighting can increase muscle fatigue and worsen pain complaints.

In addition, the results of the study also showed that the parts of the body that most often experienced MSDs complaints were the lower back, neck, shoulders, and upper extremities. These results are consistent in both national and international studies (Hosseini et al., 2025; Patel et al., 2023; Yang et al., 2023). Overall, the results of the synthesis show that the risk of MSDs increases along with unergonomic working postures, repetition of movements, long working hours, and lack of application of ergonomic principles. Ergonomics-based interventions such as work design improvement, correct posture training, and the implementation of microbreaks are recommended to reduce the level of complaints in workshop workers.

DISCUSSION

This The results of this systematic review show that complaints of Musculoskeletal Disorders (MSDs) in workshop workers are the result of a combination of individual, occupational, and work environment factors. These findings are in line with biomechanical and ergonomic theories that musculoskeletal injuries occur due to an imbalance between the body's physical capacity and repetitive or excessive workload received (Chaffin & Andersson, 1999). Work factors are the main determinants of the occurrence of MSDs. Unergonomic working postures, repetitive movements, and long work durations cause an increase in static load on muscles and joints. Based on research by Pratiwi et al. (2025) and Satriyandhi et al. (2025), most workshop workers perform activities in a bending or squatting position for more than four hours every day. This condition increases the risk of disorders in the lower back and neck.

The high REBA and RULA assessments in most studies indicate the need for immediate corrective action on workplace layouts and work techniques used. Individual factors such as age, body mass index (BMI), exercise habits, and working hours also affect the risk of MSDs. Research by Linggi et al. (2024) shows that workers with high BMI and a working period of more than five years are more at risk of experiencing severe musculoskeletal complaints. On

the contrary, regular exercise or stretching habits act as protective factors against muscle fatigue (Fajri & Modjo, 2023). These findings reinforce the view that the prevention of MSDs needs to be focused not only on employment factors, but also on improving the physical capacity of individual workers. In addition to physical factors, several studies have also highlighted the influence of psychosocial factors on the incidence of MSDs. According to Hosseini et al. (2025) and Yang et al. (2023), work stress, time pressure, and low control over work contribute to an increase in musculoskeletal complaints.

The Demand-Control Model (Karasek, 1979) explains that when high work demands are not balanced with adequate work control, the risk of injury and fatigue increases significantly. Environmental factors such as machine vibration, hot temperatures, and substandard lighting have also been shown to worsen the physical condition of workers. Chronic vibrations from heavy equipment can cause disturbances in the peripheral nervous system, while excessive heat accelerates muscle fatigue (Saikhunuddin et al., 2024).

Poor lighting conditions also increase visual fatigue and change working position, which ultimately worsens the working posture. The findings of this study support the theory of Human Factors and Ergonomics (McCormick & Sanders, 1987), which emphasizes the importance of adjustment between humans and work systems. The application of ergonomics in the workshop environment, such as the use of a workbench of an appropriate height, weightlifting aids and a good ventilation system, can significantly reduce the risk of MSDs. Overall, the results of this study confirm that the problem of MSDs in workshop workers is multifactorial. Effective prevention requires an integrated approach that includes workplace engineering, working time management, ergonomics training, and increased worker awareness of physical health and fitness. Thus, ergonomics-based interventions are a key solution to reduce the prevalence of MSDs in informal sectors such as automotive repair shops. compliance.

CONCLUSION

Mental The results of a systematic review showed that the incidence of Musculoskeletal Disorders (MSDs) in workshop workers is caused by a complex interaction between individual, occupational and work environmental factors. The most dominant factors affecting MSDs are unergonomic working posture, repetition of movements, long working duration, and excessive physical load. In addition, individual factors such as age, working period, and body mass index also increase the risk, while exercise habits play a protective factor. Environmental factors such as engine vibration, hot temperatures, and inadequate lighting also exacerbate musculoskeletal complaints. Complaints are most common in the lower back, neck, and shoulders, reflecting the unergonomic working position and high static load experienced by workshop workers. Efforts to prevent MSDs need to be carried out comprehensively through the application of ergonomics principles in the workplace, training in safe work techniques, structuring a balanced work schedule with microbreaks, and developing physical fitness programs for workers. Increasing awareness of the importance of ergonomics in the informal sector is expected to reduce the risk of injury and increase work productivity in a sustainable manner.

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