



Application of the Ergo-Office ROSA Method to Assess Work Posture Risks in MSME Workers in South Sumatra Province: Implications for Occupational Health

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Abstract:

Background: Computers are the main devices that support the efficiency and effectiveness of work in modern office environments, including MSMEs in South Sumatra Province. However, long-term use of computers with unergonomic sitting postures can increase the risk of *Work-Related Musculoskeletal Disorders* (WMSDs) in workers. The results of preliminary observations showed that the percentage of variation in WMSD complaints was between 13%-42% of the total work-related diseases related to computers.

Aim: This study aims to identify muscle complaints experienced by workers, analyze the risk of working posture using ergonomic methods, and provide suggestions for improvements to minimize the risk of musculoskeletal disorders.

Methods: This study uses *the Rapid Office Strain Assessment* (ROSA) method to assess the risk of computerized and sitting activity-based work postures. In addition, *Nordic Body Map* was used to map the location of muscle complaints in respondents. The study was conducted on 20 workers in four MSMEs in South Sumatra Province who worked with high computer intensity.

Results: The analysis showed that all four respondents had a high level of occupational posture risk based on the ROSA score. A total of 36 muscle complaints were reported, with the most complaints located in the lower neck, waist, and buttocks. The main factors causing complaints include prolonged static sitting positions and inadequate adjustment of work facilities.

Conclusions: The work posture of MSME workers in South Sumatra Province indicates a level of ergonomic risks that requires serious attention. Interventions such as improving work facilities and training in correct work posture are highly recommended.

Implementation. These findings affirm the importance of applying ergonomic principles in computer-based work environments to prevent WMSDs, improve work comfort, and support the productivity of government sector workers.

Keywords: Ergonomics, NBM, ROSA, work posture, computer user workers.



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INTRODUCTION

The use of computers has become a crucial element in supporting work productivity in the digital era, especially in the government administration sector. The results of the study found that the average office worker spends 75% of his or her working time in a sitting position in front of a computer. (Sovi et al., 2025; Amalia & Wahyuningsih, 2024; Sutarto et al., 2022). Although computers can increase work efficiency and effectiveness, prolonged use without considering ergonomic principles can potentially cause serious health problems. Common complaints that workers often experience include headaches, stress, muscle pain, to tension in the neck, back, and upper extremities (Avinante et al., 2021). Static and unergonomic sitting postures, especially in long working durations, are one of the factors causing an increase in incidents of *Musculoskeletal Disorders* (MSDs), especially types of Work-Related Musculoskeletal Disorders (WMSDs) (MF et al., 2023)(Aprianto et al., 2021). These disorders include complaints of skeletal muscles such as the neck, shoulders, hands, lower back, and waist, which are directly correlated with work activities (Disorders et al., 2024). Dominant causative factors for WMSDs include movement repetition, non-neutral posture, and excessive muscle stretching, plus high work duration (4–8 hours per day) (Wardani et al., 2023).

To identify such complaints systematically, the *Nordic Body Map* (NBM) widely used because it is able to visually map the location of muscle complaints in workers (Sansabila et al., 2024). Several previous studies have utilized NBM in the context of manual and conventional work, such as the manufacturing industry's process of moving finished products to forklifts (Zahra & Prastawa, 2023). However, until now, there is still limited research that integrates the NBM method in a computer-based government work environment, especially in technical units such as waste management. Along with the increasing need for quantitative data-driven ergonomics studies, the *Rapid Office Strain Assessment* (ROSE) emerged as a relevant and applicable evaluation tool in the office environment. ROSA allows for a thorough assessment of workstation elements such as chairs, *monitor, Keyboard, Mouse*, and phone based on posture and duration of work (Jayadi et al., 2020). This method has been widely used in healthcare settings and the private sector,

but its application in the local government sector is still minimal, even though ergonomic conditions in this sector tend to go unnoticed.

The novelty of this study lies in the integrative approach between the ROSA and NBM methods to analyze ergonomics risks thoroughly in 20 workers in four MSMEs in South Sumatra Province, a sample from four MSMEs in Regencies/Cities in South Sumatra Province is a context that has not been studied much before. Another peculiarity is the focus on non-field technical workers who use computers intensively in administrative work. This group often misses ergonomics studies, even though they show a high tendency to the risk of WMSDs. Through preliminary observations, it was found that the percentage of variation in WMSD complaints is between 13%-42% of the total work-related diseases related to computers. Many workers in four MSMEs in South Sumatra Province work without paying attention to posture ergonomics that suit their activity. The work posture of workers and their work activities with computers in 4 MSMEs in South Sumatra Province are presented in Figure 1.



Figure 1. Work posture and work activities with a computer

Therefore, this study aims to fill the *literature* gap related to the application of office ergonomics in four MSME environments in South Sumatra Province, by providing data-based recommendations for improving work facilities and worker work posture. The results of this study are expected to be the basis for ergonomics policy making in the MSME office sector whose work activities are computer-based, in order to create a work environment that is more ENASE (effective, comfortable, safe, healthy, efficient) and has high productivity.

LITERATURE REVIEW

Work-Related Musculoskeletal Disorders (WMSDs)

Work-Related Musculoskeletal Disorders (WMSDs) are disorders of the muscular system and skeletal body that arise from work activities that are repetitive, static, and carried

out over a long period of time without paying attention to ergonomic principles. These disorders include pain, stiffness, or injury to the neck, shoulders, arms, back, waist, and lower extremities. WMSDs are one of the most common occupational health issues in the office environment, especially for workers who use computers for long periods of time. According to Matos and Pedro (2015), more than 75% of administrative workers' working time is spent sitting in front of a computer. Without ergonomic posture support, this condition can trigger muscle tension and chronic disorders of the musculoskeletal system. Therefore, monitoring work posture and the distribution of muscle complaints is a critical aspect in improving the quality of occupational health and productivity.

Nordic Body Map (NBM)

The *Nordic Body Map* (NBM) questionnaire was developed by Kuorinka et al. as an international standard measurement tool for identifying muscle complaints based on how workers perceive the location of their body. NBM operates on the principle of a self-reported checklist, combined with illustrations of human body maps, to make it easier for workers to identify areas of complaint. NBM has been widely used in ergonomics research because of its ease in quickly collecting subjective complaint data and its ability to detect specific complaint locations. Some studies that utilize NBM include research by Wahyuni et al. (2022) on convection screen printing workers and guillotine machine operators in the manufacturing industry. However, the use of NBM in the public service sector, especially government offices, is still minimal, and this represents an area for contribution in this study.

Rapid Office Strain Assessment (ROSA)

Rapid Office Strain Assessment (ROSA) is an observational method developed by Village and Rempel (2010) to analyze work posture risk in a computer-based office environment. ROSA assesses the interaction between various work components, such as chairs, *monitors, keyboards, mice,* and phones. This method divides the assessment into three *main sections*: Section A: Chair-related work posture, Section B: *Monitor and telephone,* and Section C: *Keyboard and mouse.* ROSA uses a scoring system from 1 to 10, where a score of >5 indicates a high level of risk and the need for immediate ergonomic intervention. The advantage of this method is its ability to provide a thorough ergonomic assessment without the need for complex measuring instruments, making it ideal for application in office environments with a wide variety of working positions. Several previous studies using

ROSA have demonstrated its effectiveness in identifying and reducing ergonomic risks, including among healthcare network staff, banking computer operators, and academic environments.

This research has the following methodological novelty and context: the integration of NBM and ROSA methods into a single analytical framework has not been widely carried out in the context of ergonomics studies in the office environment of four MSMEs in South Sumatra Province, particularly in the work units of MSMEs oriented towards computer-based work. The direct application in MSMEs in regencies/regional cities, which have so far paid little attention to administrative work ergonomics, makes a practical contribution to the formulation of occupational health policies in the computer-based worker sector. Triangulation of NBM subjective and objective ROSA data results in more comprehensive and accurate analysis results, while supporting data-driven decision-making for ergonomic interventions. The ROSA score-based recommendations are designed to be easily implemented by MSMEs with limited resources, making this research relevant and applicable on a national and local scale.

METHOD

Research Design

This study is a quantitative descriptive study with an observational approach that aims to identify and evaluate the risks of posture-based work ergonomics and skeletal muscle complaints in workers of four MSMEs in South Sumatra Province who work using computers. This research is focused on the divisions/sections of MSMEs that use computer devices in daily work activities. The method used integrates the NBM questionnaire as a tool for identifying muscle complaints and ROSA as the main method of occupational posture risk analysis. Literature studies begin with NBM and ROSA and field studies through direct observation and interviews. Data was collected through NBM questionnaires, ROSA worksheets, and work posture documentation. Data processing includes; recapitulation of muscle complaint data, processing of work posture documentation data with Microsoft visio, calculation of section A-B-C scores, calculation of monitor and peripherals scores, and calculation of ROSA final scores. Analysis of results and conclusions and implications.

Research Instruments

Nordic Body Map (NBM)

NBM is a structured ergonomics questionnaire equipped with illustrations of human body maps, aiming to identify the location and intensity of musculoskeletal complaints systematically. The body map in NBM is divided into nine main parts, namely: 1) Neck, 2) Shoulders, 3) Upper back, 4) Elbows, 5) Lower back, 6) Wrists/hands, 7) Waist/buttocks, 8) Knees, and 9) Heels/feet. This questionnaire was given to all respondents to determine the distribution and level of muscle complaints resulting from repetitive and static work activities.

Rapid Office Strain Assessment (ROSA)

ROSA is a visual observation-based ergonomic evaluation method used to assess the level of risk from work posture in an office environment. ROSA divides the work component into three main parts: *Section A*: Evaluation of the chair components and the way workers sit, *Section B*: Evaluation of *the position of the monitor* and the use of the phone, and *Section C*: Evaluation of the use of *the keyboard and mouse*. The results of *Sections B and C* are calculated into *monitor and peripheral* scores, which are then combined with *Section A* scores to obtain *the total ROSA* score. The interpretation of the final ROSA score is as follows: Score ≤ 3 : Low risk, Score 4-5: Medium risk, and Score > 5 : High risk. Immediate ergonomic intervention is required. The ROSA method was chosen because it is efficient, practical, and relevant for complex administrative work environments, and allows for rapid detection of ergonomic risks without specialized laboratory equipment.

Research Procedure

The stages of the research are carried out as follows: (1) Initial Identification: Initial observation is carried out to obtain an overview of the working conditions and posture of workers. (2) NBM Questionnaire: All participants are asked to fill out a questionnaire to identify points of musculoskeletal complaint. (3) Direct Observation and Documentation: Observation of the work posture is carried out directly, accompanied by visual documentation. (4) ROSA Scoring: Each work element is observed and assessed according to the ROSA criteria until the final score of work posture risk is obtained. (5) Analysis and Recommendations: The results of identification from NBM and ROSA are analyzed to prepare recommendations for improving posture and work facilities.

Methodological Novelty

This study presents novelties in terms of methodological approach and the context of its application: (1) NBM-ROSA Integration in Sector 4 of MSMEs in South Sumatra Province: The combination of NBM and ROSA methods has not been widely applied simultaneously in the study of ergonomics in 4 MSMEs in South Sumatra Province holistically, especially in non-field work units such as divisions/sections 4 of MSMEs whose work is computer-based. (2) Practical Application in 4 MSMEs in one South Sumatra Province: This study focuses on the work environment of the MSME sector, which has intensive administrative work characteristics but little attention to ergonomics. (3) Use of Visual-Observational Approach: The combination of subjective data from NBM respondents with objective data from ROSA direct observation made the results stronger in terms of data triangulation validity. (4) Specific Intervention Recommendations: This research does not stop at risk identification, but continues on the formulation of specific and applicable ergonomic solutions to improve occupational safety.

DISCUSSION

Muscle Complaint Analysis Based on *Nordic Body Map* (NBM)

The *Nordic Body Map* (NBM) questionnaire used the Guttman scale assessment, which is a scale of sick and non-sick answers, assessing muscles in 28 parts of the body. Data collection was carried out on 20 workers of division/section 4 of MSMEs in South Sumatra Province who worked in a computer-based environment. Workers in this division work for 7-8 hours per day using computer components and chairs. The musculoskeletal complaints of 20 workers are presented in Figure 2.

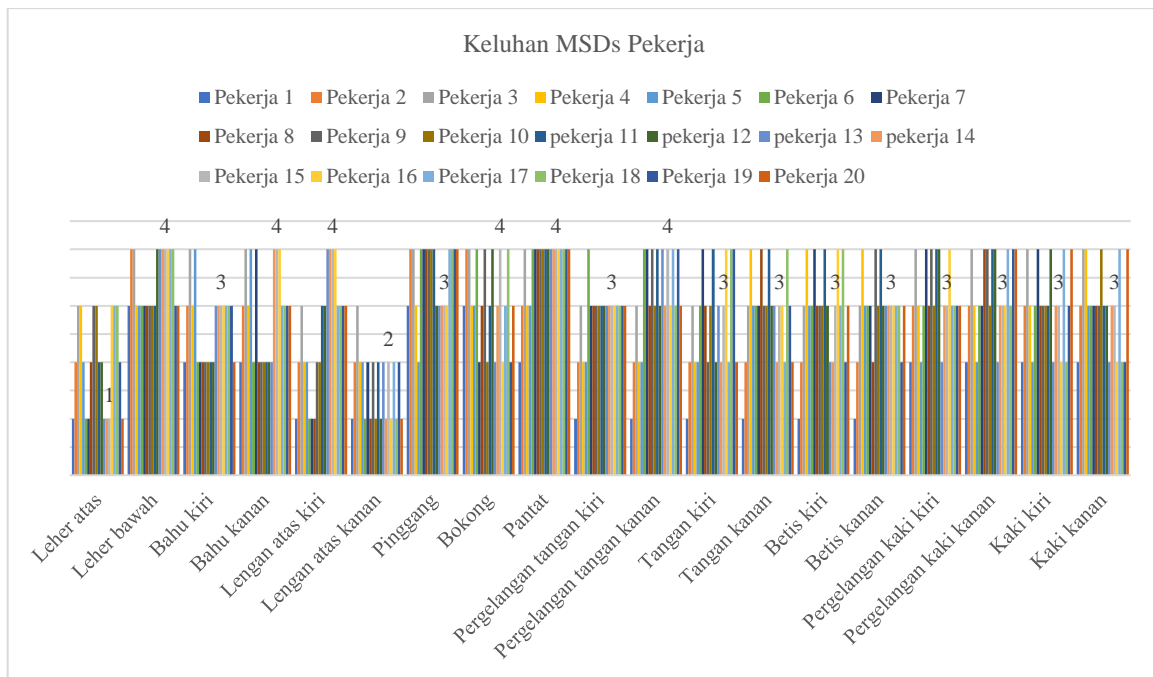


Figure 2. Workers' musculoskeletal complaints based on the NBM questionnaire

The results of filling out the NBM questionnaire showed that 36 muscle complaints were reported among all respondents. The most dominant complaints are *in the lower neck (cervical), lower back (lumbar), and buttocks (gluteus)*. These findings indicate that static sitting positions and prolonged use of computers cause pressure on areas of the body that continuously support the body's load. These results reinforce the findings of Matos & Pedro (2015) and Tarwaka et al. (2004), who stated that intensive computer use without ergonomic posture increases the risk of *Work-Related Musculoskeletal Disorders (WMSDs)*. Complaints of the neck and lower back generally occur due to the head being too low or misaligned with the monitor, as well as inadequate chair support against the curvature of the lower spine.

Work Posture Risk Analysis Based on the ROSA Method

An evaluation of work posture using *the Rapid Office Strain Assessment (ROSA)* method showed that nine workers had a ROSA score above the risk threshold, which was >5. This score indicates that the worker's working posture is classified as high-risk and requires immediate ergonomic intervention. An assessment of each *Section* in ROSA reveals several key issues: *Section A (Chair)*: Many seats do not have adequate height adjustment or lumbar support. *Section B (Monitor and Phone)*: The monitor is too low or out of alignment with the eyesight, causing pressure on the neck. *Section C (Keyboard and Mouse)*: Keyboard

and mouse positions are too far or too high, forcing the wrists and arms to be in a non-neutral position. This mismatch directly impacts posture while working, and if left unattended for a long time, it can lead to cumulative injuries to the musculoskeletal system. This finding is in line with research by Village & Rempel (2010), which confirms that a ROSA score of >5 is a significant indicator of ergonomic risks in the office environment.

Relationship between NBM and ROSA

The integration of subjective data (muscle complaints from NBM) and observational data (posture analysis from ROSA) provides a comprehensive picture of ergonomic conditions in the workplace. The finding of a match between the location of muscle complaints (e.g., neck and lower back) and problematic work posture components (monitor position and chair support) suggests that this combined approach is practical in identifying the source of ergonomic problems holistically. Based on the data from the NBM questionnaire shown in Figure 2, it can be seen that the most common muscle complaints experienced by workers are in the lower neck, waist, and buttocks, with a frequency of 12.45% of the total complaints each. Section A scoring assesses a person's working posture in relation to the use of chair components. The data in this section includes seat height, seat depth, armrest, and backrest data. The following is the data from the observations. *Section B* scoring assesses a person's work posture towards the use of monitor and phone components. The following is the data from the observations. *Section C* scoring assesses a person's work posture towards the use of the mouse and keyboard components. The following is the data from the observations. The determination of *peripherals and monitor scores* is based on data from section B (monitor and phone scores) and section C (mouse and keyboard scores).

The determination of the ROSA score in this section is based on data from the seat score and the *peripherals and monitor* score. The ROSA score of each worker is shown in Table 1.

Based on the calculation of the ROSA score, it can be seen that 9 out of 20 workers have a ROSA score above 5, which is considered a risky work posture. This risk factor occurs because some workers have not paid attention to the ergonomic aspects of work, such as reaching the mouse too far and maintaining a typing position that is not straight (causing the wrist to bend upwards). In addition, office facilities also affect the risk factors related to workers' postures. This is evident from the fact that some office facilities have not addressed

ergonomic needs, such as chairs that are not adjustable for some workers, the absence of document holders, desks that are too high for some people, and small monitor screens. Based on the interview results, it was discovered that there were damaged seat components, preventing essential functions on the chair, such as seat height adjustment, from working correctly. The lack of worker awareness and supportive office facilities affects the emergence of MSD complaints felt by workers. Therefore, improvements are needed to support comfort, health, and safety at work.

Table 1. ROSA Score

Employee Name	ROSA Score	Peripheral and Monitor Score	ROSA Score	Information
Worker 1	6	6	5	Risky
Worker 2	3	3	6	No Risk
Worker 3	5	3	5	No Risk
Employee 4	6	3	4	No Risk
Worker 5	6	5	5	Risky
Worker 6	4	3	5	No Risk
Worker 7	5	4	4	No Risk
Worker 8	5	5	7	Risky
Employee 9	7	4	4	No Risk
Employee 10	7	5	6	Risky
Worker 11	4	5	3	No Risk
Worker 12	5	6	4	Risky
Worker 13	5	4	3	No Risk
Worker 14	5	7	6	Risky
Employee 15	6	7	6	Risky
Worker 16	6	7	7	Risky
Worker 17	4	5	3	No Risk
Employee 18	6	5	6	Risky
Worker 19	5	5	4	No Risk
Worker 20	3	5	4	No Risk

Improvements to work facilities are necessary because some facilities still lack ergonomic support, such as non-adjustable chairs that do not align with the worker's posture, leading to back muscle complaints. The application of this adjustable chair is essential because it not only adjusts the posture of the chair components but also changes the height of the desk used by workers. Furthermore, considering the many complaints about neck issues among workers, it is recommended that they use document holders. Using this document holder can reduce the risk of neck muscle complaints. Doing muscle stretching and exercise routines. Muscle stretching can be done for 10-15 minutes every 1 hour of work. Meanwhile, sports such as *gymnastics* and *jogging* can be done once a week to improve blood circulation and reduce the risk of muscle complaints. Some of the improvement

proposals given can reduce the risk of muscle complaints in workers, allowing them to work more safely and comfortably without affecting work performance.

Ergonomics Implications and Improvement Recommendations

These findings highlight the urgent need for four MSMEs in South Sumatra Province, especially for the 20 workers in computer-based environments, to improve workstation design and work posture education. After knowing the *musculoskeletal* complaints and ROSA scores in workers, the proposed improvement actions that can be given to reduce the occurrence of muscle complaints are as follows: 1) Procurement of ergonomic chairs with height adjustment, backrest, and lumbar support. It is used to reduce muscle complaints in the arms and elbows. A good backrest has a non-hard surface texture. The seat height is adjusted while working so that the knee position relaxes and forms a 90° angle. A good sitting position is 95°-110°. 2) Height adjustment of the *monitor* is in line with the eye view to prevent neck tension. Set *the monitor* 40-75 cm away from the worker and parallel to the line of sight to minimize fatigue on the neck and eye muscles. 3) Position *the keyboard and mouse* as close to the body as possible to minimize shoulder and wrist strain. And 4) Regular ergonomics training for workers on the importance of correct working posture and light stretching. By implementing such measures, not only can the risk of WMSDs be reduced, but productivity and job satisfaction among workers can also be significantly increased. One socialization medium for visualizing standard work postures is office ergonomics posters in the work environment. This is because posters are an effective medium in accelerating readers' understanding of the message presented.

CONCLUSION

This study comprehensively identified and analyzed ergonomic risks in workers in the Waste Management division of the Batam City Environmental Agency through a combination of the *Nordic Body Map* (NBM) and *Rapid Office Strain Assessment* (ROSA) methods. The results showed that most workers experienced significant musculoskeletal complaints, especially in the lower neck, lower back, and buttock areas, which directly correlated with unergonomic work postures during computer use. ROSA analysis showed that four workers had a risk value above the threshold (score >5), which indicates the need for immediate ergonomic interventions to reduce the risk of injury due to poor working

posture. These findings confirm that current workstations do not support optimal ergonomic principles.

Based on the results of the analysis and calculations, it is known that workers experience 36 muscle complaints. The most common areas are the lower neck, waist, and buttocks, each with a frequency of 12.45%. Based on the assessment of work posture using the ROSA method, it is known that 9 out of 20 workers have a ROSA score of more than 5, indicating that their work posture is at risk. The existence of muscle complaints experienced by workers and this risky work posture indicates that corrective action is needed. Improvement actions that can be taken by four MSMEs in South Sumatra Province are socializing the application of ergonomics in the office, improving work facilities, stretching muscles, and regular exercise for workers.

Scientifically, this study contributes to strengthening the validation of the combined use of NBM and ROSA as a holistic approach in ergonomic risk assessment in office work environments. This approach not only identifies subjective complaints from workers but also objectively maps the sources of risk based on work elements such as chairs, *monitors*, *phones*, *keyboards*, and *mice*. The practical implications of this study include: 1) The importance of redesigning workstations in accordance with ergonomic principles to prevent WMSDs. 2) The need for ergonomics training for workers to build awareness of the importance of good work posture. 3) The use of ROSA as a continuous monitoring tool in ergonomic risk management in government agencies. With the proper recommendations in place, organizations can create a healthier, safer, and more productive work environment while minimizing the potential for long-term workplace injuries.

IMPLEMENTATION

The results of this study strongly imply the need for systematic and sustainable ergonomic interventions in the work environment of 4 MSMEs in South Sumatra Province. The application of the ROSA method has successfully identified several high-risk work postures that, if left unchecked, have the potential to significantly increase the prevalence of musculoskeletal disorders (MSDs) among workers. Key implications drawn from these findings include: a) Urgency of Workstation Re-design: Rearrangement of workstations and task equipment should be a priority to conform to ergonomic principles, to lower the ROSA risk score and reduce the biomechanical load on the working body. b) Occupational Health and Safety (K3) Policy: Local governments need to develop a more proactive OSH policy

based on ergonomics data, including the integration of regular ROSA assessments in occupational risk evaluation programs. c) Risk-Based Ergonomics Training: A regular training program is needed for workers to increase awareness and ability to recognize and correct sub-optimal work postures. d) Monitoring and Evaluation of Workers' Health: It is recommended that a long-term occupational health monitoring system be established to detect early symptoms of musculoskeletal disorders, thus allowing for more timely preventive interventions. And e) Special Budget Allocation for Ergonomics: These results support the need for a dedicated budget allocation for the procurement of ergonomic work aids and ergonomist expert consultation as part of an investment in worker productivity and well-being.

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