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Measuring the Risk Level of Worker Discomfort Due to Computer Use Using the ROSA Method

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ABSTRACT

Computer work carried out for long periods of time can increase the risk of musculoskeletal disorders (MSD) in workers. Working posture is important to increase productivity among workers. Unergonomic posture is one of the main factors causing MSD. This research aims to analyze risks to computer workers using the Rapid Office Strain Assessment (ROSA) method and provide recommendations for improvements to improve work compatibility. The Rapid Office Strain Assessment (ROSA) method is used to determine the risk value of work activities that use computers and sitting posture. The research results obtained showed that office employees were categorized as requiring further assessment and required follow-up action. Office employees have risky working postures and experience muscle complaints. Based on these results, there are several recommendations such as engineering controls and administrative controls.

Keywords: *Employee, Ergonomics, ROSA, Work posture.*

Introduction

Long-term computer users are susceptible to a variety of distractions that might lower productivity. Reduced performance can be caused by a variety of circumstances, including environmental distractions, physical, mental, and psychological exhaustion. Physical fatigue due to prolonged sitting, unergonomic body posture, and exposure to computer screen radiation can cause muscle pain, headaches, and eye fatigue. Mental fatigue and difficulty concentrating arise due to excessive focus on screens, multitasking, and lack of social interaction. Work stress, anxiety, frustration and boredom can also reduce work morale and productivity. Workload is a task given to employees and must be completed within a predetermined time, with conditions. This means that it is not uncommon for the workload borne by employees to make them feel bored and even stressed at work, resulting in disrupted work productivity [1].

The impact of productivity disruption is a decrease in work quality, an increase in the number of errors, delays in completing tasks, increased absenteeism, and high employee turnover. The solution to overcome this problem is to provide recommendations to workers such as arranging rest time, physical activity, stress management, and creating a conducive work environment. Improving communication and collaboration and implementing healthy computer usage policies can also help improve worker performance.

Ergonomics is the study of designing and arranging things people use so that the people and things interact most efficiently and safely [2]. The purpose of ergonomics is to design and arrange workspaces, products, and systems in a way that optimizes human well-being and overall performance. Ergonomics aims to prevent injuries and musculoskeletal disorders by ensuring that the environment fits the individual's physical and cognitive capabilities, ultimately enhancing efficiency, comfort, and safety in various settings [3]. Ergonomically optimized kitchen layouts can reduce the risk of musculoskeletal problems resulting from awkward postures and repetitive motions, such as back pain and repetitive strain injuries, thus improving the physical health of individual users [4].

Office Ergonomics involves educational activities for employees to identify risk factors for work-related MSDs, select appropriate work practices and equipment, and adjust their workstation for a comfortable working environment [5]. The purpose of office ergonomics is to promote occupational health and well-being in the workplace through initiatives such as workplace interventions, virtual ergonomics training, and e-learning modules. These efforts aim to improve employee health, knowledge,

and overall well-being, ultimately leading to a positive impact on employees and organizations [6]. Office ergonomics can reduce the risk to workers by providing personalized behavior change tools that inform workers of potential ergonomic risks throughout their daily work, helping them adjust their postures to minimize ergonomic risks [7].

Rapid Office Strain Assessment (ROSA) is a tool developed to quickly quantify risks associated with computer workstations and establish action levels for change based on reports of worker discomfort [8]. The purpose of the Rapid Office Strain Assessment (ROSA) is to quickly quantify the exposure of workers to risk factors in office workplaces related to work-related musculoskeletal disorders (WRMSD) and determine if further assessment or intervention is needed [9]. The office ROSA method can reduce the risk to workers by assessing work postures and durations related to computer use, identifying risks, and recommending changes to improve posture or work facilities based on discomfort reports [10].

Work posture refers to the position of the body during work tasks. It can be influenced by factors such as mental workload, time constraints, and interruptions, leading to changes in body postures that may increase the risk of musculoskeletal disorders [11]. The purpose of work posture is to prevent musculoskeletal disorders (MSD) among fishermen by ensuring they work in a good position that reduces the risk of injury and strain [12]. Ergonomic interventions, such as optimizing office work posture, can reduce the risk of musculoskeletal disorders and errors in dental procedures [13].

Musculoskeletal disorders (MSDs) refer to a group of conditions that affect the muscles, tendons, ligaments, nerves, and other soft tissues, as well as bones and joints in the body. These disorders can result from various factors such as repetitive movements, awkward postures, forceful exertions, and prolonged standing, which are common in occupations that involve manual labor or repetitive tasks [14]. Musculoskeletal disorders, such as osteoarthritis and intervertebral disc degeneration, are significant as they are the leading cause of years lived with disability and can severely impact a person's ability to work and overall quality of life [15]. Implementing ergonomic workstations, providing training on proper lifting techniques, encouraging regular breaks to move and stretch, and promoting good posture can help reduce the risk of office musculoskeletal disorders among workers [16].

Research Methods

Based on the research conducted, there is a research flow which includes determining the object of research, identifying problems, collecting data, and analyzing data. The following is the research flow used in completing this research:

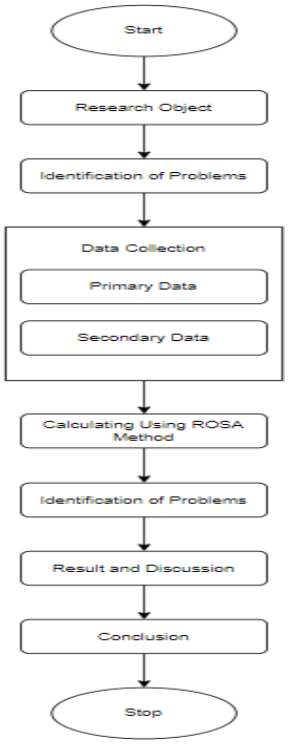


Figure. 1. Research flow

Based on Fig.1, research flow, the research begins with stages in the form of determining the object of research and then identifying the problem. Then there are two ways of collecting data, namely using primary data and secondary data. After the data is collected, calculate using the ROSA method which then identifies problems from office workers. The results of data processing will be a reference for office to improve workers' working posture. The final step is to conclude the research that has been done.

Ergonomic

To effectively reduce physical fatigue caused by prolonged sitting, unergonomic body posture, and exposure to computer screen radiation, implementing ergonomic principles is crucial. Start by adjusting the height of the chair and desk to ensure proper alignment [17]. Rest feet flat on the floor or a footrest, with knees at a 90-degree angle. Invest in an ergonomic chair that supports lower back and allows for adjustments in seat height, armrests, and backrest angle. Maintain a neutral body posture while seated, keeping shoulders relaxed and back supported by the chair's backrest. Position computer screen at eye level and about an arm's length away to minimize strain on the neck and eyes, and consider using an anti- glare screen or adjusting lighting to reduce glare. Take regular breaks using the 20-20-20 rule—every 20 minutes, look at something 20 feet away for 20 seconds—to relax eyes and prevent eye fatigue [18]. Additionally, incorporate ergonomic accessories such as wrist rests and document holders to optimize keyboard and mouse placement. Ensure proper lighting in the workspace and consider using blue light blocking glasses to reduce exposure to screen radiation. Educate the colleagues about the importance of ergonomic practices and encourage regular adjustments to workstations to promote comfort, productivity, and overall well-being. Regularly reassessing and adapting setup based on ergonomic principles will help prevent physical discomfort and fatigue associated with prolonged sitting and computer use.

Office Ergonomic

Implementing effective office ergonomics is essential for reducing worker fatigue and promoting overall well-being. Start by assessing and optimizing workstation design to support proper posture and comfort. Ensure that desks and chairs are adjustable to accommodate individual preferences, with ergonomic chairs offering lumbar support and adjustable armrests [19]. Position computer monitors at eye level and encourages the use of document holders to reduce strain on the neck and shoulders during tasks. Promote regular breaks and movement throughout the workday, incorporating the 20-20-20 rule to reduce eye strain from prolonged screen use. Provide ergonomic keyboards and mice to support natural wrist positioning and minimize wrist strain. Consider offering adjustable standing desks or encouraging alternating between sitting and standing to combat the effects of prolonged sitting. Ensure proper lighting to reduce eye strain and fatigue, supplementing with task lighting if necessary. Educate workers on ergonomic practices and encourage them to report any discomfort for prompt evaluation and adjustment. Implement job rotation or task variation to prevent overuse injuries and reduce mental and physical fatigue associated with repetitive tasks. Regularly assess and adjust ergonomic conditions based on feedback to continuously improve workplace ergonomics and enhance worker comfort, productivity, and overall health. By prioritizing office ergonomics, workplaces can create a supportive environment that minimizes physical strain and fatigue, benefiting both employees and the organization [20].

ROSA Method

Implementing a Rapid Office Strain Assessment (ROSA) to analyze fatigue in office workers involves a systematic approach to evaluating ergonomic risks and making necessary improvements. Begin by training designated assessors on the ROSA tool and its assessment criteria to ensure accurate evaluations. Identify specific areas within the office environment, such as workstations, seating arrangements, lighting, and equipment usage, to assess using ROSA [21]. Conduct assessments using the ROSA checklist to evaluate factors like posture, workstation setup, task demands, and environmental conditions. Assign scores based on assessment findings and collect additional data through worker interviews or surveys to gather subjective feedback on ergonomic issues and fatigue symptoms. Analyze the data to identify high-risk areas and prevalent ergonomic issues contributing to worker fatigue. Develop an action plan outlining interventions such as workstation adjustments, ergonomic equipment provision, or changes in work practices to address identified risks. Continuously monitor the effectiveness of interventions through follow-up assessments and feedback from workers, adjusting strategies as needed based on evolving work demands or workforce demographics. Document assessment results, interventions, and outcomes to demonstrate the impact of ROSA implementation on reducing worker fatigue and promoting ergonomic well-being within the organization. By following this structured approach, organizations can proactively improve office ergonomics and enhance worker health, comfort, and productivity [22].

Work Posture

Implementing effective work posture strategies to reduce and analyze fatigue among office workers involves a comprehensive approach centered on ergonomic principles and employee education. Start by conducting thorough ergonomic assessments of office workstations to identify any ergonomic risk factors contributing to poor posture and fatigue [23]. Educate employees through training sessions on the importance of maintaining proper posture while working, including tips on chair adjustment, maintaining a neutral spine alignment, and positioning computer equipment ergonomically. Encourage frequent movement and breaks throughout the workday, incorporating strategies like the 20-20-20 rule to reduce eye strain and encourage posture changes. Provide ergonomic workstation setups with adjustable chairs featuring lumbar support, height-adjustable desks or monitor stands, ergonomic keyboards and mice, and footrests as needed. Consider offering sit-stand desks to allow employees to alternate between sitting and standing. Regularly monitor and adjust workstation setups based on employee feedback and follow-up assessments to address any new ergonomic issues or discomfort. Encourage a culture of ergonomics within the workplace by promoting open communication about ergonomic concerns and reinforcing the importance of good posture and ergonomics practices. By prioritizing these strategies, organizations can significantly reduce office worker fatigue associated with poor posture and create a healthier, more comfortable work environment that supports employee well-being and productivity [24].

Musculoskeletal Disorders

To reduce musculoskeletal disorders (MSDs) and office worker fatigue effectively, organizations should implement a comprehensive approach focusing on ergonomics, education, and support. Begin by conducting ergonomic assessments of workstations and tasks to identify risk factors like poor posture, repetitive motions, or inadequate equipment setup that contribute to MSDs and fatigue [25]. Provide thorough ergonomic training and workshops to educate employees on proper workstation setup, posture, and safe work practices. Encourage regular breaks and movement throughout the day, incorporating strategies like the 20-20-20 rule to reduce eye strain and muscle fatigue. Equip workstations with ergonomic chairs, adjustable desks, and ergonomic tools to support proper body alignment and reduce strain. Educate employees on proper lifting techniques and implement job rotation to vary tasks and prevent overuse injuries. Address stress management and promote a culture of health and safety by providing resources for stress reduction and work-life balance. Continuously monitor workplace conditions, gather employee feedback, and modify processes or environments as needed to create a supportive and comfortable workspace. By prioritizing these strategies, organizations can foster a healthier and more productive work environment while reducing the incidence of MSDs and worker fatigue. Regular evaluation and adaptation of these measures based on feedback are key to sustaining improvements in employee well-being and organizational performance [26].

Results and Discussion

In this study there was one worker who was used as a respondent:

Name: Wikino
Work period: 7 Months
Workload: 8 hours

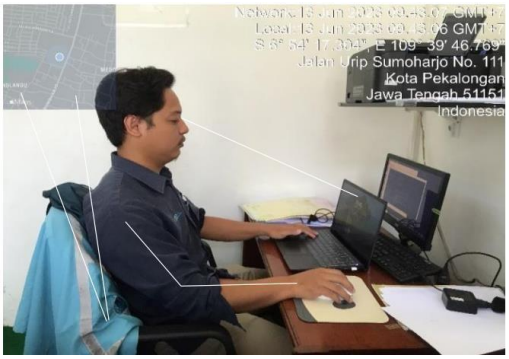


Figure 2. Upper body working posture

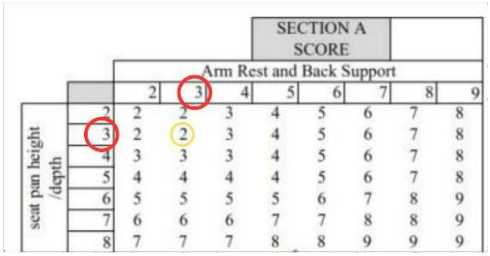
Figure 3. Lower body working posture

The calculation of the score obtained from the ROSA sheet:

1. The first score calculation is to calculate **GROUP A** consisting of Chair height, Pan depth, Armrest, Back support.

Table 1. Section A Classification

GROUP A	
Component	**Score**
Chair height	1
Pan depth	2
Armrest	2
Back support	1



SECTION A SCORE									
	Arm Rest and Back Support								
seat pan height /depth	2	3	4	5	6	7	8	9
2	2	2	3	4	5	6	7	8
3	2	2	3	4	5	6	7	8
4	3	3	3	4	5	6	7	8
5	4	4	4	4	5	6	7	8
6	5	5	5	5	6	7	8	9
7	6	6	6	7	7	8	8	9
8	7	7	7	8	8	9	9	9

Figure 4. Section A Score Calculation

Based on the table, it is known that the results of the Chair height + Pan depth score = 1 + 2 = 3, Armrest+ Back support = 2 + 1 = 3, so the results are obtained according to the table above, which is 2, but because in this case the respondent worked continuously for one hour, it will be added (+1), so the score for Group A is 3.

2. The second score calculation is to calculate **GROUP B** consisting of Monitor and Telephone

Table 2. Section B Classification

GROUP B	
Component	**Score**
Monitor	3

GROUP B	
Component	**Score**
Duration	1
Telephone	1
Duration	1

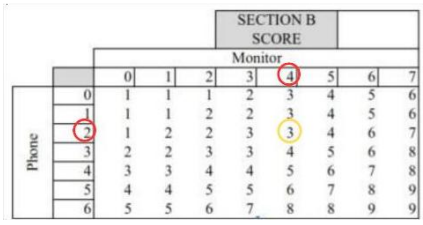


Figure 5. Section B Score Calculation

Based on the table, it is known that the results of the Monitor + Duration = 3 + 1 = 4, Phone + Duration = 1 + 1 = 2, so that the results are obtained according to the table above, which is 3, so the Score for Group B is 3.

3. The third score calculation is to perform calculations on **GROUP C** consisting of Mouse and Keyboard.

Table 3. Section C Classification

GROUP C	
Component	**Score**
Mouse	1
Duration	1
Keyboard	1
Duration	1

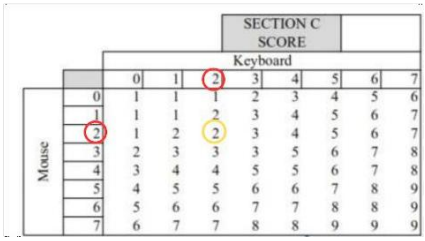


Figure 6. Section C score calculation

Based on the table, it is known that the results of the Keyboard + Duration score = 1 + 1 = 2, Keyboard + Duration = 1 + 1 = 2, so the results are obtained according to the table above, which is 2, but because in this case the respondent works continuously for one hour, it will be added (+1), so the score for Group C is 3.

4. The fourth score calculation is to calculate the **Peripherals Score** consisting of Mouse & Keyboard and Monitor & Phone.

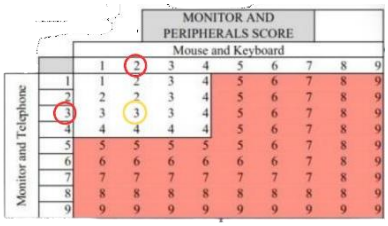


Figure 8. Peripherals score calculation

Based on the table, it is known that the score results are Monitor & Phone = 3, Mouse & Keyboard = 2, so the results are obtained according to the table above, which is 3

5. The fifth score calculation, which is to calculate the **Final Score** consisting of Peripheral Score and also Chair Score.

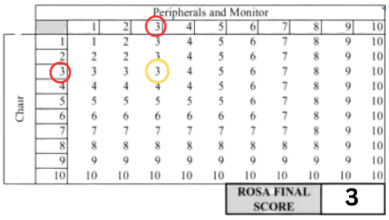


Figure 9. Final score calculation

Based on the table, it is known that the results of Peripherals score = 3, Chair Score = 3, so that the Final Score is obtained according to the table above, which is 3.

Discussion

From the calculation results using the ROSA method, a final score of 3 is obtained. Furthermore, the final score will be categorized based on the ROSA score classification in table 4.

Table 4. ROSA score category

Final Score ROSA	Ergonomic Risk Level
1-2	Low risk
3-4	Medium risk
5-7	High risk
8-10	Very high risk

Referring to the classification table above, the results of the final score calculation can be categorized into the **medium risk category**. This shows that the level of work discomfort due to computer use is still at a medium or acceptable level. However, there are several aspects that are at risk of causing injury, including table positions too low/chair height too high. A desk position that is too low or a chair that is too high can result in unnatural posture while working. This discomfort can cause excessive tension in the muscles and joints, especially in the back, neck, and shoulders. This non-ergonomic posture increases the risk of injuries such as back pain, neck pain, and other joint and muscle problems. This problem can develop into a serious musculoskeletal disorder in the long term.

Long duration of work

Requiring workers to maintain a static posture over a long period of work, i.e. from morning to evening for about 8 hours a day, for 6 days a week, can have a significant impact on their physical and mental health. This condition can lead to excessive physical fatigue as well as mental fatigue, which in turn

can reduce their concentration and slow down the response to the task at hand. In addition, fatigue also increases the risk of work errors that may have an impact on productivity and the quality of work performed.

Recommendations

Based on the results of the analysis of causal factors that can increase ergonomic risks, steps to minimize these risks and prevent potential health problems related to ergonomics can be taken. One of them is through administrative control regarding ergonomic practices in the office environment to employees. In addition, engineering control in the form of improvements to workstations can also be carried out to improve the comfort and health of employees. These measures aim to create a healthier and ergonomic physical work environment, as well as prevent employees from developing Work-Related Musculoskeletal Disorders (WMDS) caused by non-ergonomic workloads. Thus, this effort is expected to provide benefits for the overall welfare and productivity of employees.

1. Engineering control

Engineering control in the work environment is an important approach to ensuring the physical well-being and health of employees. These measures aim to reduce the risk of injury or discomfort caused by non-ergonomic work postures. One of the main steps is to regulate the physical condition of the workplace, and here are some strategies that can be applied:

- Adjusting the Chair Height and Setting Feet on the Floor
  It is important to adjust the height of the chair to match the height of the workbench or other work surface. In addition, it is also important to teach employees to set foot comfortably on the floor. Thus, the position of the body will be more stable and the pressure on the lower part of the spine can be reduced.
- Setting Monitor Height and Computer Placement
  Computer monitors should be set at a height that keeps the eyes parallel or slightly below the monitor. This helps prevent rotation of the spine and neck. In addition, it is also necessary to place the computer straight on the axis of the body to reduce pressure on the upper part of the body.
- Set the Placement of Work Components and Devices on the Desk
  Work components and devices should be placed on the workbench based on the work zone to avoid the position of the arms that have to reach excessively. It aims to help reduce pressure on muscles and joints, especially on shoulders and arms. Component and work device placement settings can be adjusted according to the following table

Table 5. Recomendation distance placement

Dimension		Distance
Zone A	Frequently used areas the hand reaches out to such as the mouse, keyboard, and work documents	25-30 cm
Zone B	Rarely used areas of the hand reach out in a forward outstretched posture	50 cm
Zone C	Occasional hand-held areas, such as folders or inactive documents or reference documents.	100 cm

2. Administrative control

Administrative control in the work environment is an important measure to manage ergonomic risks and educate employees about occupational health. Here are some strategies that can be applied:

- Pay attention to periodic rest and stretching schedules
  Employees are advised to take short breaks or stretches every 20 minutes while working on a computer. The 20-20-20 method can be applied, where every 20 minutes of work is followed by a short break for 20 seconds, as well as doing eye rest by focusing on objects 20 feet away. Stretching should also be done every 2 hours of work, with a duration of 10-15 minutes, to reduce muscle stiffness and improve blood circulation.
- Ergonomics Socialization
  It is important to socialize the importance of working ergonomically to all employees. This can be done through training, seminars, or group discussions that discuss proper ergonomic practices to maintain health and comfort during work.
- Educational media

To strengthen awareness of ergonomics, companies can create print media such as posters or stickers that contain information on how to stretch, correct sitting posture, proper use of keyboard and mouse, and guidelines for adjusting chair height. These media can be placed in the work area as a visual reminder to employees of healthy ergonomic practices.

Figure 10. Stretching Guide

Figure 11. Educational media of ergonomic

By implementing these control recommendations, it is expected that companies can reduce the risk of injury or ergonomic discomfort associated with the work of employees. This will help create a healthier and more productive work environment, as well as improve overall well-being.

Conclusion

The conclusions obtained from this research are as follows:

1. From the calculation results using the ROSA method, the final score was 3.
2. Several factors can cause injury, such as the position of the table being too low or the chair being too high and also the worker's long working duration.
3. Recommendations given to reduce risk factors are suggestions for improving work posture and work facilities. Recommendations for improving work posture given are posture for using a chair, posture for using a monitor, posture for using a telephone, posture for using a mouse, posture for using a keyboard.

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