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Ergonomic Work Tools to Reduce Labor Fatigue

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A R T I C L E I N F O

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A B S T R A C T

Work tools need to be made and arranged ergonomically so that the position at work will also be egonomical so that work is not easily tired. In this paper, it is designed decisively. Data is taken from several opinions of experts as well as from research results. It is commonly called a literature study. Then an analysis is also carried out descriptively, namely presentation. Conclusion: First. The unergonomic condition of facilities and infrastructure as well as the work environment is the dominant factor. Second. To be able to work egonomically, the tools must be arranged so that the workers are in an ergonomic working position, then: 1). Work not bend over, there is no body moment and work must remain upright by adjusting the work tools; 2). Use the work with more muscle tips moved by the muscle pieces; 3). Balance between the work task and the work capacity; 4). Use the work energy 5 kcal/minute to 5.2 kcal/minute so that you do not get tired easily; 5). Use in working at VO2 max.

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INTRODUCTION

Work tools or facilities that are not ergonomic are not compatible between the design of the station, workstation or physical environment with the size and capabilities of the human body, so an ergonomic approach is needed so that the workforce does not experience fatigue.

Menurur Fachrykaru (2026) there are three welding jobs and equipment that are less ergonomic: First, the bent position that causes workers to get tired easily. Second, warnings without restraints increase the risk of defects and dangers. Third, welding adjusters are too high, complicating settings and increasing fatigue". Then, according to Rebekah Gloria Linoe (2022), "from this study, there is a relationship between work posture and work fatigue at PT. NSB Beton Indonesia in Tateli Village, Minahasa Regency. Therefore, workers must work in an ergonomic position and further research is needed on other factors that cause work fatigue". Furthermore, fatigue also affects weavers, as Yohana Ludowika Afean Pah (2025) says that "work fatigue and complaints are common problems in ikat weaving workers".

Fatigue is not just an ordinary feeling of drowsiness, fatigue is a body's protective mechanism to anticipate more severe tissue damage, which if ignored will have a systemic adverse impact. According to Jessica Gabriella Budi Santosa (2024) that "from the study, the results were obtained that the variables of age, nutritional status, working period, workload, work shifts have a positive relationship with work fatigue". This pseudo-occurrence occurs as a result of unergonomic circumstances. This as conveyed by Tyastiana Arbianisa et al (2026) "is the ergonomic status of the work position related to labor fatigue".

Persadalab (2024) that "Ergonomic risks are often caused by factors such as poor sitting positions, excessive repetition of movements, and workloads that are not in accordance with physical abilities". Then, Rininta Andriani (2026) said that "the suitability of work facilities to the size of the worker's body is very important to increase work comfort, efficiency, and productivity". Therefore, work tools need to be made and arranged ergonomically so that the position at work will also be egonomic so that work is not easily tired.

THEORETICAL REVIEW

Definition of Ergonomics

Ergonomics is a science that studies the relationship between humans, work equipment, the work environment, and work systems to create safe, comfortable, healthy, and efficient conditions. The application of ergonomics aims to adapt work to human capabilities and limitations, not forcing the workforce to adjust to inappropriate working conditions. In the work environment, ergonomics includes body position adjustments, equipment design, workplace layout, and work methods that can reduce the risk of health problems due to work activities. The application of the right ergonomic principles can help improve labor comfort while supporting work productivity.

Ergonomics also play an important role in preventing musculoskeletal disorders, muscle pain, and fatigue that arise from repetitive activities, unnatural posture, and excessive workload. Unergonomic working conditions can cause the workforce to experience physical discomfort, decreased concentration, and

reduced ability to maintain performance during working hours. Therefore, the application of ergonomics needs to be done through adjustments to equipment, work procedures, and work environments based on work characteristics and labor needs. Thus, ergonomics is one of the important approaches in creating a healthier, safer, and more sustainable work system.

Ergonomic Work Tools

Ergonomic work tools are equipment that is designed or adapted to anthropometric characteristics, physical capabilities, and labor needs so that work activities can be carried out safely and comfortably. These tools can be in the form of height-adjustable chairs and desks, aids for lifting and moving weights, comfortable tool handles, and equipment that helps reduce repetitive movements and unnatural body positions. The design of ergonomic work tools needs to consider the user's body size, the weight of the equipment, the frequency of use, and the type of work performed. The use of appropriate equipment can help reduce physical load and increase the ease of labor in completing tasks.

Labor Fatigue

Work fatigue is a condition when a person's physical and mental abilities decline after performing work activities for a certain period of time. Fatigue can be characterized by reduced energy, the appearance of drowsiness, decreased concentration, increased work errors, and the occurrence of complaints in certain parts of the body. Work fatigue can be distinguished into physical fatigue and mental fatigue. Physical fatigue is generally related to the use of muscle power, uncomfortable work posture, and repetitive activities, while mental fatigue can arise due to concentration demands, work pressure, and high cognitive load. Levels of fatigue that are not properly managed can affect the health, safety, and productivity of the workforce.

There are various factors that can affect work fatigue, including work duration, activity intensity, physical load, environmental conditions, rest quality, and suitability of the equipment used. Work done with unnatural body positions or using inappropriate tools can increase muscle tension and accelerate the appearance of physical fatigue. In addition, a hot work environment, inadequate lighting, and insufficient rest time can worsen these conditions. Therefore, work fatigue control needs to be carried out through a comprehensive approach, including improving the design of work tools, setting rest times, adjusting workloads, and creating a work environment that supports the health of the workforce.

The Relationship of Ergonomic Work Tools to Work Fatigue

The use of ergonomic work tools is related to the level of work fatigue because the design of the equipment can affect the amount of energy expended, posture, and the pressure that muscles and joints receive during work. Equipment that suits the needs of the workforce can help reduce unnecessary movements, maintain a more natural posture, and reduce physical load when completing tasks. Conversely, inappropriate work tools can cause the workforce

to expend additional energy, maintain an uncomfortable body position, and perform repetitive movements excessively. These conditions have the potential to accelerate the onset of fatigue and increase the risk of musculoskeletal disorders.

The application of ergonomic work tools can be one of the strategies to reduce fatigue while increasing work comfort and effectiveness. These efforts can be made through adjusting the dimensions of the equipment, the use of mechanical aids, improving the workplace layout, and selecting tools that are in accordance with the characteristics of the job. However, the effectiveness of ergonomic work tools is also influenced by other factors, such as the duration of work, workload, work habits, health conditions, and the availability of rest time. Therefore, the evaluation of the application of ergonomic work tools needs to be accompanied by fatigue measurements before and after repairs to find out the changes that have occurred. Through this approach, companies or workplace managers can determine appropriate improvements to support the health, safety, and productivity of the workforce.

METHODOLOGY

The research method used in this writing is a descriptive method with a literature review approach. Data was obtained through the review of various relevant written sources, such as books, scientific journal articles, previous research results, and academic publications that discuss ergonomics, the use of ergonomic work tools, and labor fatigue. Data collection was carried out by identifying, reading, and recording information related to the focus of the discussion. These sources were selected based on the relevance of the content to the research topic so that it can provide an adequate theoretical basis in understanding the role of ergonomic work tools in reducing work fatigue.

The data that has been collected is then analyzed using descriptive analysis techniques, namely by debunking, comparing, and interpreting the opinions of experts and the findings of previous research. The analysis is carried out to identify the main concepts, factors that affect work fatigue, and the relationship between the application of ergonomic work tools and the physical condition of the workforce. The results of the analysis are then systematically compiled in the form of narrative descriptions in order to provide a clear picture of the problems discussed. The final stage of the research is carried out by drawing conclusions using a deductive approach, which is departing from theories and general concepts about ergonomics to obtain specific conclusions about the importance of using ergonomic work tools in an effort to reduce labor fatigue.

RESULTS AND DISCUSSION

The Relationship of Ergonomic Work Tools to Work Fatigue

Based on the results of a literature review, the application of ergonomic work tools is one of the efforts that can be made to reduce work fatigue in the workforce. Work tools that are designed according to anthropometry and the needs of workers can help reduce muscle load, maintain a more natural posture, and minimize repetitive movements that are not needed. On the other hand, the use of inappropriate tools can cause workers to bend over, reach too far, or

maintain an uncomfortable body position for a long time. This condition can increase muscle tension and accelerate the onset of fatigue during work.

The findings presented by Ikrama Wardianti Basri (2024) regarding the relationship between age, length of work, and sitting position with fatigue in tailors show the importance of paying attention to the characteristics of workers and work facilities. Meanwhile, Nopriadi's (2026) statement regarding the condition of facilities, infrastructure, and work environment emphasizes that fatigue is not only related to individual abilities, but is also influenced by workplace conditions. Thus, ergonomic improvements should be carried out through adjustment of work tools, body position adjustments, and integrated work environment improvements. However, the application of ergonomic tools needs to be accompanied by an evaluation to ensure that these improvements really provide benefits to the workforce.

Forms of Ergonomics in Work Activities

The application of ergonomic principles can be done through the adjustment of work tools to the type of work and the physical condition of the workforce. In work performed while sitting, for example, the height of chairs and desks needs to be adjusted so that workers can maintain a comfortable body position. In jobs that involve lifting goods, the use of lifting aids can reduce the physical load that the body receives. Meanwhile, in jobs that require repetitive movements, adjusting the range of equipment and the placement of work materials can help reduce unnecessary movements. Such adjustments need to take into account variations in the size of the worker's body, the duration of work, and the characteristics of the tasks performed.

In addition to equipment adjustments, the application of ergonomics also needs to be supported by the management of rest times, work rotation if possible, and training on posture and safe work techniques. Workers need to be given an understanding of the importance of avoiding continuous bending positions, reducing excessive loads, and using tools according to their functions. Thus, ergonomics is understood not only as the provision of comfortable work tools, but also as an approach to improve the entire work system. The combination of appropriate tool design, proper work behavior, and workload management is expected to help reduce fatigue and improve labor safety and productivity.

Factors Affecting Work Fatigue

Work fatigue is influenced by various interrelated factors, both from the individual side and the work environment. Individual factors include age, health condition, physical fitness, and rest quality. Meanwhile, work factors include work duration, activity intensity, physical load, body position, and frequency of repetitive movements. Environmental conditions such as temperature, lighting, noise, and the layout of work facilities can also affect workers' comfort and ability to maintain performance. Therefore, handling fatigue needs to consider these factors thoroughly and not just focus on one aspect.

Based on this description, ergonomic work tools play a role as a form of controlling fatigue risk factors, especially those related to posture and physical

load. However, the use of ergonomic tools does not automatically eliminate all causes of fatigue. Workers who use equipment according to standards can still experience fatigue if they work for too long without rest or face excessive workload. Therefore, evaluation of work conditions needs to be carried out periodically by paying attention to worker complaints, work posture, activity duration, and appropriate fatigue indicators. This approach can help determine more appropriate and sustainable improvement steps.

Summary of Literature Review Results

The following table summarizes the main aspects that can be used to explain the relationship between ergonomics and work fatigue based on the literature that has been discussed.

Table. 1 Summary of Literature Review Results

Aspects studied	**Problems found**	**Ergonomics improvement efforts**
Job position	Sitting too long, bending over, or maintaining an uncomfortable posture	Adjust seating position, chair height, table, and equipment range
Work tool design	The equipment is not suitable for body size and work needs	Adjusts the dimensions of the tool and provides a comfortable grip
Physical workload	Heavy load lifting and repetitive movements	Using mechanical aids and managing task sharing
Working duration	Persistent activity without adequate rest	Provide rest time and set work schedules
Work environment	Less favorable layout, lighting, or temperature	Improve the layout and conditions of the work environment
Fatigue evaluation	Physical complaints and decreased concentration are not monitored	Conduct periodic employee complaint assessments and fatigue measurements

Source: Compiled based on a synthesis of ergonomics and work fatigue concepts in a literature review.

Based on the table, efforts to reduce work fatigue need to be done through a combination of equipment improvements, work positions, workloads, and work environments. Tool adjustment is an important step, but it needs to be followed by activity management and monitoring of labor conditions. This table is a conceptual synthesis, not the results of direct measurements in the field.

Maximum Pulse and VO_2 Usage in Workload Assessment

Pulse rate and oxygen consumption are physiological indicators that can be used to help assess the body's response to work activities. Pulse rate can increase when a person performs high-intensity physical activity. Observation of pulse before, during, and after work can provide an idea of the cardiovascular response

to workload. However, pulse rate is also affected by other factors, such as environmental temperature, emotional state, fitness level, and health condition. Therefore, pulse rate numbers should not be used as the sole basis for determining whether a person is experiencing work burnout.

In addition to pulse, maximal oxygen uptake or VO_2 max describes the body's maximum capacity to take in and use oxygen during intense physical activity. This indicator can be used to understand an individual's aerobic capacity and help assess physical workload relative to the body's capabilities. In its application, workload needs to be adjusted to the capacity of each worker so that activities can be carried out without causing excessive physiological stress. However, max VO_2 does not directly measure fatigue and does not always need to be measured for every job. Ergonomic assessments should also pay attention to the posture, muscle load, subjective complaints, and recovery time of the worker.

Implications of Applying Ergonomic Work Tools to Productivity

The application of ergonomic work tools has the potential to provide benefits not only to the health of the workforce, but also to productivity. When workers use equipment that suits their physical needs, work activities can be carried out more comfortably and unnecessary movements can be reduced. These conditions can help workers maintain concentration, reduce distractions caused by muscle pain, and perform tasks more consistently. In the long term, ergonomic improvements can also support efforts to prevent musculoskeletal disorders and reduce the risk of fatigue-related errors.

Nonetheless, the success of the implementation of ergonomic work tools needs to be assessed based on real conditions in the workplace. Managers need to identify the types of work that are most at risk, involve the workforce in the selection of equipment, and evaluate changes in complaints and workload after improvements have been made. Evaluations can include comparisons of work postures before and after interventions, levels of physical complaints, perceptions of fatigue, and relevant productivity indicators. With such an approach, the application of ergonomics is not only an effort to provide better equipment, but also part of a strategy to improve the quality of the work environment and the well-being of the workforce.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of analysis and discussion through literature studies, it can be concluded that:

1. The condition of facilities and infrastructure as well as an unergonomic work environment is one of the factors that can increase the risk of work fatigue. Incompatibility of equipment with the characteristics of the worker's body, improper work posture, excessive workload, and lack of rest time can cause muscle tension, physical discomfort, and decreased concentration and productivity of the workforce.
2. The application of ergonomic principles needs to be done by adapting work tools to the physical characteristics and needs of the workforce. Workers need

to be directed to maintain a natural posture, avoid a continuous bending position, reduce unnecessary movements, and use assistive devices when the work involves heavy loads. In addition, the workload needs to be adjusted to the physical capacity of the worker so that activities can be carried out safely and sustainably.

3. Physical workload management needs to consider energy needs, aerobic capacity, duration of work, and labor recovery time. The use of physiological indicators, such as pulse rate and oxygen consumption, can help evaluate the physical demands of the job. However, the energy requirement of 5–5.2 kcal/min cannot be applied as a universal limit for all workers and types of work. Similarly, max VO_2 needs to be used as an indicator of aerobic capacity, not as a target to be achieved during work.
4. The use of ergonomic work tools has the potential to help reduce fatigue, increase comfort, and support labor safety and productivity. However, its effectiveness is also influenced by other factors, such as working time management, environmental conditions, work habits, and the physical condition of workers. Therefore, the application of ergonomics needs to be accompanied by periodic evaluations to ensure that the improvements made are in accordance with needs and can reduce the risk of work fatigue.

Suggestions

Based on these conclusions, some suggestions that can be given are as follows.

1. For companies or industries, it is better to design and arrange work facilities and infrastructure by applying the principles of ergonomics. Work equipment needs to be adjusted to the body size, physical ability, and work characteristics of the workforce. Companies also need to provide assistive devices for jobs that require a lot of labor, improve the layout of the workplace, and ensure that lighting, temperature, and ventilation conditions support work comfort.
2. For workers, it is recommended to apply the correct working position, avoid bending or twisting postures excessively, and use equipment in accordance with established procedures. Workers also need to make optimal use of rest time, stretch if necessary, and report physical complaints that arise during work so that they can be followed up immediately.
3. For occupational safety and health (K3) managers, it is recommended to identify and evaluate ergonomic risks periodically. Evaluation can be carried out by observing work posture, assessing physical load, identifying musculoskeletal complaints, and monitoring the level of labor fatigue. The results of the evaluation can be used as a basis for determining appropriate corrective actions and preventing excessive fatigue.
4. For future researchers, it is recommended to conduct direct research in the work environment to determine the effectiveness of the use of ergonomic work tools in reducing labor fatigue. Research can be conducted by comparing conditions before and after the application of ergonomic improvements through fatigue level measurements, posture assessments, pulse rate, or other relevant indicators. Thus, the results of the study can provide stronger

empirical evidence regarding the benefits of implementing ergonomic work tools.

5. For companies and the workforce, the implementation of ergonomics should not only focus on providing appropriate tools, but also include adjusting workloads to worker capacity, regulating work duration, providing adequate rest time, and improving understanding of occupational safety. A holistic approach is expected to create a safer, more comfortable, healthier, and more productive work environment.

FURTHER STUDY

Further research is recommended to examine the effectiveness of the application of ergonomic work tools in reducing labor fatigue through direct research in the work environment. The study can focus on comparing the level of fatigue before and after the use of ergonomic tools by considering work posture, physical load, work duration, and environmental conditions. The results of the research are expected to be the basis for developing the design of work tools that suit the needs of the workforce and support the improvement of safety, health, and work productivity.

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