

ERGONOMIC PROBLEMS IN LIGHT INDUSTRY ENTERPRISES AND THEIR IMPACT ON OCCUPATIONAL DISEASES

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Abstract

This article analyzes ergonomic risk factors encountered in light industry enterprises and their impact on employees' health from the perspective of occupational safety and labor protection. Improper workplace organization that does not meet ergonomic requirements, repetitive movements, uncomfortable working postures, and insufficient rest periods are considered the main factors leading to occupational diseases and reduced labor productivity. The research findings show that ergonomic improvement of workplaces, regular monitoring of risk factors, implementation of modern technical solutions, and strengthening preventive measures play an important role in reducing occupational risks. The article also develops practical recommendations for creating safe working conditions in light industry enterprises.

Keywords

labor protection, occupational safety, ergonomics, light industry, occupational risk, occupational diseases.

INTRODUCTION

Today, ensuring occupational safety and protecting employees' health is one of the most important components of industrial production processes and a key indicator of effective labor management. In modern industrial systems, especially in labor-intensive sectors such as light industry, the interaction between human capabilities and working conditions plays a decisive role in determining both productivity and safety levels. Therefore, integrating occupational safety principles with ergonomic requirements has become an important scientific and practical direction for improving working conditions. Light industry enterprises are characterized by high labor intensity, the dominance of manual work, and continuous and repetitive technological processes. In such production

environments, workers are often required to maintain static working postures for long periods, repeatedly perform hand and body movements, and remain under constant physical load throughout the working shift. These conditions significantly increase biomechanical stress on the human body and create favorable conditions for the development of ergonomic risk factors. In sewing, textile, garment, and footwear production sectors, workers often work in sitting, standing, or bent positions for extended periods and are unable to sufficiently change their posture. In addition, many workplaces are not fully designed according to anthropometric and biomechanical principles, meaning that the height of work surfaces, seating arrangements, equipment layout, and working distances are not properly adapted to human physiological characteristics. As a result, workers are forced to maintain unnatural body positions, which leads to continuous strain on muscles, joints, and the spine. Such unfavorable working conditions are recognized as major factors contributing to the development of occupational diseases. The most common health problems include musculoskeletal disorders such as lower back pain, neck and shoulder pain, joint dysfunction, and repetitive strain injuries. Furthermore, prolonged physical stress and insufficient rest contribute to chronic fatigue syndrome, reduced concentration, psychological stress, and decreased overall work capacity. These health problems negatively affect not only individual workers but also overall production efficiency and workplace safety. Ergonomics is a scientific discipline focused on designing and organizing work systems in accordance with human anatomical, physiological, and psychological characteristics. Its main goal is to optimize the interaction between humans, machines, and the working environment in order to improve safety, efficiency, and comfort. Within occupational safety systems, ergonomic principles are applied to reduce excessive physical load, prevent work-related injuries, and improve long-term working capacity.

Modern ergonomic approaches include workplace optimization, adaptation of equipment to human body dimensions, improvement of working posture, reduction of repetitive strain, and implementation of micro-break systems. In addition, automation and mechanization of production processes are considered effective methods for reducing workers' direct exposure to hazardous physical loads. Although technological modernization and automation are widely implemented in modern industrial sectors, many light industry enterprises still do not fully comply with ergonomic standards. This is due to outdated equipment, insufficient workplace redesign, lack of ergonomic training, and limited occupational health monitoring systems. As a result, workers remain exposed to

preventable ergonomic risks, which may gradually develop into serious health problems over time. Therefore, studying ergonomic problems in depth, scientifically analyzing their role in the development of occupational diseases, and developing effective preventive and corrective measures remain highly relevant tasks. A comprehensive approach that integrates engineering solutions, organizational improvements, and occupational health management systems is necessary to ensure safe working conditions. Such an approach not only protects employees' health but also contributes to increased labor productivity, reduced absenteeism, and improved production efficiency in light industry enterprises.

MAIN PART

Production processes in light industry enterprises are characterized by a high level of labor intensity, continuous workflow, and a strong dependence on human physical performance. Unlike highly automated industries, many operations in sewing, textile, garment, and footwear production still rely heavily on manual labor and repetitive human movements. In such conditions, even small deficiencies in workplace design or organization can significantly increase ergonomic stress and contribute to the development of occupational health problems over time. One of the most critical issues in these enterprises is the mismatch between workplace design and human anthropometric and biomechanical characteristics. Workstations are often standardized without sufficient consideration of worker height, reach distance, visual comfort, and joint movement angles. As a result, workers are forced to adapt their bodies to the workplace rather than the workplace being adapted to the worker. This leads to prolonged awkward postures such as forward bending, elevated shoulder positioning, and prolonged sitting without proper lumbar support, all of which increase mechanical stress on the musculoskeletal system.

In sewing and textile production, repetitive motion is one of the dominant risk factors. Workers perform the same hand, wrist, and arm movements thousands of times during a shift. Over time, this repetitive strain leads to microtrauma in muscles, tendons, and joints. Combined with static posture, this significantly increases the risk of developing musculoskeletal disorders (MSDs), particularly in the lumbar spine, cervical region, shoulders, and upper limbs. These disorders often develop gradually and may become chronic, leading to long-term reduction in working capacity. Another important ergonomic issue is inadequate workplace environmental conditions, including insufficient lighting, poor ventilation, excessive noise, and poorly arranged working spaces. Improper lighting conditions force workers to strain their vision, often resulting in poor posture adjustments

such as leaning closer to work surfaces. This indirectly increases neck and back strain. Similarly, limited workspace or poorly arranged equipment restricts movement, forcing workers to maintain constrained positions for long periods. In addition, organizational factors play a significant role in the development of ergonomic risks. In many enterprises, work-rest schedules are not properly regulated, and production targets are prioritized over physiological recovery. Continuous work without sufficient micro-breaks leads to the accumulation of fatigue and reduces the body's ability to recover from physical stress. Over time, this condition results in chronic musculoskeletal overload and decreased functional capacity. Scientific studies consistently show that prolonged exposure to ergonomic risk factors significantly increases the prevalence of work-related musculoskeletal disorders (WMSDs), including lower back pain, cervical osteochondrosis, tendonitis, and carpal tunnel syndrome. These conditions not only reduce individual work capacity but also increase absenteeism, medical costs, and production inefficiencies within enterprises. In many cases, affected workers require long-term medical treatment or are forced to change their occupation. In addition to physical health effects, ergonomic risks also have significant psychological consequences. Monotonous work, sustained physical strain, and insufficient recovery time contribute to chronic fatigue, reduced attention span, irritability, and increased psychological stress. These factors negatively affect cognitive performance and decision-making ability, increasing the likelihood of human error during production processes. Consequently, the risk of occupational accidents and injuries also increases.

Modern occupational safety and ergonomics research, including findings from international health organizations, emphasizes that proper ergonomic design of workplaces is one of the most effective preventive strategies against occupational diseases. Ergonomic optimization involves adapting tools, equipment, and workstations to human capabilities, thereby reducing unnecessary physical load and improving efficiency. This includes adjusting work surface heights, improving seating design, ensuring proper visual alignment, reducing unnecessary repetitive movements, and improving workplace spatial organization. A comprehensive approach is required to effectively reduce ergonomic problems in light industry enterprises. Such an approach includes engineering interventions (redesigning workplaces and equipment), organizational measures (optimizing work-rest cycles and job rotation), and technical improvements (introducing semi-automation and automation where possible). Among these, job rotation systems are particularly effective, as they reduce prolonged exposure of specific muscle groups to

continuous strain. Training and awareness programs are also essential components of ergonomic risk prevention. Workers should be educated on correct working posture, safe movement techniques, and early symptoms of musculoskeletal disorders. Supervisory staff and occupational safety engineers must also be trained to identify ergonomic hazards and implement corrective measures in a timely manner. Continuous monitoring of workplace conditions is also necessary for early detection of risk factors. From a scientific perspective, ergonomic interventions not only reduce the incidence of occupational diseases but also significantly improve labor productivity. When workplaces are designed according to human capabilities, energy expenditure decreases, fatigue accumulates more slowly, and concentration levels remain higher throughout the working shift. This leads to improved work quality, fewer errors, and more stable production output.

Furthermore, ergonomic improvements contribute to long-term economic benefits for enterprises. Reduced sick leave, lower compensation costs, improved employee retention, and increased productivity collectively enhance the overall efficiency of production systems. Therefore, investment in ergonomic design should be considered not as an additional cost but as a strategic factor in sustainable industrial development. Overall, addressing ergonomic problems in light industry enterprises requires a systematic and evidence-based approach. Ergonomic risk assessment, workplace redesign, continuous monitoring, and preventive interventions should be integrated into the occupational safety management system. Such integration ensures not only the protection of workers' health but also the sustainable improvement of production efficiency and workplace safety culture.

CONCLUSION

The analysis of ergonomic problems in light industry enterprises shows that the inadequate adaptation of workplaces to human physiological and anthropometric characteristics is one of the main factors in the development of occupational diseases. Prolonged static working postures, highly repetitive movements, and unfavorable working conditions lead to musculoskeletal disorders, chronic fatigue, and reduced labor productivity. The negative impact of ergonomic risk factors on the production process affects not only employees' health but also the economic efficiency of enterprises. The increase in occupational diseases results in temporary or permanent loss of workforce, interruptions in production processes, and additional economic costs. The research findings confirm that the full implementation of ergonomic principles within production systems plays a crucial role in ensuring occupational safety. Ergonomic risks can be

significantly reduced by adapting workplaces to human capabilities, modernizing production equipment, rationally organizing work processes, and introducing micro-break systems. In addition, the regular implementation of ergonomic preventive measures helps to protect workers' health, maintain their long-term working capacity, and increase labor productivity. This is a key condition for creating a safe and sustainable working environment in enterprises. Overall, addressing ergonomic problems in light industry enterprises through a comprehensive and scientifically based approach is an important direction in improving occupational safety systems and is effective in preventing occupational diseases.

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