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The Relationship Between Gadget Exposure and Musculoskeletal Complaints among Office Workers

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Abstract

Excessive gadget use has become a significant occupational health concern, particularly among office workers who spend extended hours using computers, smartphones, and other digital devices. Prolonged exposure often leads to poor posture, repetitive movements, and increased risk of musculoskeletal disorders (MSDs). This study aims to investigate the relationship between gadget exposure and musculoskeletal complaints among office workers. A cross-sectional survey was conducted involving 250 office employees in Jakarta, Indonesia, and Beijing, China. Data were collected using a standardized questionnaire that assessed duration of gadget use, ergonomic practices, and musculoskeletal symptoms. The results indicated that office workers who used gadgets for more than 6 hours daily had a significantly higher prevalence of neck pain (62.8%), lower back pain (48.5%), and wrist discomfort (35.4%) compared to those with shorter exposure ($p < 0.05$). Multivariate analysis confirmed that prolonged gadget use, lack of ergonomic awareness, and absence of rest breaks were independent predictors of musculoskeletal complaints. These findings highlight the urgent need for ergonomic interventions and organizational policies promoting healthy digital habits. This research contributes to occupational health literature by providing cross-cultural evidence of gadget-related musculoskeletal risks and emphasizing preventive workplace strategies.

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Introduction

The rapid advancement of digital technology has transformed workplace practices, particularly in office settings where gadgets such as computers, smartphones, and tablets are integral to daily tasks (Trask & Linderoth, 2023). While these devices enhance productivity and connectivity, prolonged use has raised concerns about potential adverse health effects, particularly musculoskeletal disorders (MSDs) (Eitivipart et al., 2018). MSDs are among the most common

occupational health problems worldwide, affecting millions of workers and contributing to reduced quality of life and work performance (Bonfiglioli et al., 2022).

Several studies have reported a strong association between sedentary work, repetitive gadget use, and musculoskeletal complaints, particularly in the neck, shoulders, wrists, and lower back (Gosain et al., 2022). Poor ergonomics, static postures, and extended screen time are major risk factors exacerbating these conditions (Basakci et al., 2022). Despite increasing awareness, many office workers underestimate the cumulative impact of gadget use on musculoskeletal health (AlOmar et al., 2021).

The literature shows a growing body of evidence linking prolonged computer and smartphone use to specific symptoms, including neck stiffness, back pain, and carpal tunnel syndrome (Sharan et al., 2014). However, most existing research focuses on either single-device use or limited populations, leaving a gap in understanding the combined effect of multiple gadgets in diverse workplace environments.

Moreover, cultural and organizational differences may influence how office workers adopt gadget use and ergonomic practices (Al-Qahtani et al., 2019). Comparative research across different countries is still limited, making it difficult to generalize findings globally. This highlights the need for cross-cultural studies to assess whether patterns of gadget use and musculoskeletal complaints are consistent across office settings in different regions.

Another challenge lies in the lack of standardized guidelines on optimal gadget use in workplaces. Although some ergonomic recommendations exist, implementation varies widely depending on organizational policies and worker awareness (Esmaeilzadeh et al., 2014). Consequently, office workers often develop musculoskeletal problems before preventive measures are adopted.

To address these research gaps, this study investigates the relationship between gadget exposure and musculoskeletal complaints among office workers in Indonesia and China. By adopting a cross-sectional design, this study aims to compare patterns across two Asian countries with similar digital work environments but different organizational cultures.

The main objective is to determine whether prolonged gadget use is significantly associated with musculoskeletal symptoms and to identify ergonomic risk factors contributing to these complaints. The findings are expected to provide practical implications for workplace health promotion and contribute to the global discourse on occupational ergonomics.

Materials and Methods

This study applied a cross-sectional analytical design to examine the relationship between gadget exposure and musculoskeletal complaints among office workers. The research was conducted between March and August 2024 in two major urban centers, Jakarta, Indonesia, and Beijing, China. These locations were selected to represent comparable metropolitan work environments with high levels of digital device use while reflecting different organizational and cultural contexts.

Study Population and Sampling

The study population consisted of full-time office workers who routinely used digital gadgets, including desktop computers, laptops, and smartphones, as part of their daily work tasks. Eligibility criteria included employment in an office-based role, regular gadget use during working hours, and a minimum employment duration of six months to ensure sufficient exposure. Workers with a history of diagnosed musculoskeletal disorders unrelated to work or recent traumatic injuries were excluded to reduce potential confounding.

A total of 250 participants were recruited, with 125 respondents from Jakarta and 125 from Beijing. Stratified random sampling was employed to ensure balanced representation across

departments and job functions within participating organizations. This approach helped maintain comparability between the two study sites and minimized selection bias.

Data Collection Instruments

Data were collected using a self-administered structured questionnaire. The instrument was adapted from the standardized Nordic Musculoskeletal Questionnaire, which has been widely used and validated for assessing musculoskeletal symptoms in occupational settings (López-Aragón et al., 2017). The questionnaire was supplemented with items assessing ergonomic practices and gadget use patterns, consistent with prior occupational health research.

The questionnaire consisted of four main sections. The first section captured demographic characteristics, including age, sex, job position, and length of employment. The second section assessed gadget exposure, focusing on average daily duration of gadget use, types of devices used, and frequency of continuous use without breaks. Gadget exposure duration was categorized to facilitate statistical analysis. The third section evaluated ergonomic practices, such as workstation setup, posture habits, use of adjustable furniture, and awareness of ergonomic principles. The final section assessed musculoskeletal complaints experienced during the past 12 months, with a specific focus on the neck, shoulders, lower back, wrists, and hands.

To ensure clarity and consistency, the questionnaire was translated and back-translated for use in both Indonesian and Chinese contexts. A pilot test was conducted on a small group of office workers to confirm comprehensibility and reliability before full-scale data collection.

Study Variables

The primary independent variable was daily gadget exposure duration. Secondary exposure variables included ergonomic practices and rest break behavior. The dependent variables were self-reported musculoskeletal complaints in specific body regions. These complaints were recorded as binary outcomes to support inferential analysis.

Data Collection Procedure

Participants were informed about the study objectives and procedures before data collection. Informed consent was obtained from all respondents. Questionnaires were distributed electronically and completed during non-working hours to minimize disruption to work activities. Anonymity and confidentiality were strictly maintained throughout the research process.

Data Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics were used to summarize demographic characteristics, gadget use patterns, ergonomic practices, and prevalence of musculoskeletal complaints. Chi-square tests were applied to examine associations between gadget exposure categories and reported musculoskeletal symptoms.

To identify independent predictors of musculoskeletal complaints, multivariate logistic regression analysis was performed. Variables with significant associations in bivariate analysis were included in the regression model. Statistical significance was set at $p < 0.05$. Results were reported as odds ratios with corresponding confidence intervals to facilitate interpretation and replication.

Ethical Considerations

The study adhered to established ethical principles for research involving human participants. Participation was voluntary, and respondents were free to withdraw at any time without consequence. Data were used solely for research purposes and reported in aggregate form to prevent identification of individual participants.

This methodological approach ensured systematic data collection, analytical rigor, and reproducibility while maintaining alignment with established occupational health research practices.

Results and Discussion

The results of this study clearly demonstrate a strong association between prolonged gadget exposure and an increased prevalence of musculoskeletal complaints among office workers in both Indonesia and China. The high rates of neck pain, lower back pain, and wrist discomfort observed among participants reinforce the growing body of international literature that highlights the health risks associated with extensive digital device use. Neck pain in particular-reported by 62.8% of participants-emerges as the most prominent symptom. This finding is not only consistent with previous ergonomic studies but also reflects well-documented biomechanical explanations regarding the strain placed on the cervical spine during sustained forward head posture and extended screen viewing. Prolonged flexion of the neck leads to excessive loading on cervical muscles and intervertebral discs, which over time can contribute to chronic stiffness, reduced mobility, and degenerative musculoskeletal conditions.

A more detailed interpretation of the results suggests that these musculoskeletal problems arise from a complex interplay of physical, behavioral, and environmental factors. Office workers today often perform tasks that demand constant interaction with multiple gadgets-computers, smartphones, and, in some cases, tablets and dual monitors. The continuous need to switch between devices, maintain awkward postures, or repetitively perform small movements (such as typing or texting) increases cumulative strain on the musculoskeletal system. Furthermore, many participants reported not adjusting their workstations properly to match their anthropometric needs, leading to non-neutral postures that further exacerbate discomfort. For instance, improperly positioned screens may cause users to tilt their heads downward or upward for prolonged durations, while poorly arranged keyboards can contribute to wrist extension or ulnar deviation, increasing the risk for wrist pain and repetitive strain injuries.

The high prevalence of lower back pain (48.5%) found in this study also warrants attention, as it reflects the physical consequences of prolonged sitting-one of the most common risk factors in modern office environments. Workers who sit for long periods without appropriate lumbar support or without taking regular breaks may experience increased spinal compression, reduced circulation to lower back tissues, and weakening of core musculature. These effects cumulatively heighten the risk of lumbar discomfort and chronic lower back disorders. Consistent with this, logistic regression findings from this study showed that lack of rest breaks significantly increased the likelihood of musculoskeletal complaints. Without intermittent movement and posture variation, the musculoskeletal system loses its ability to adequately recover from loads imposed during prolonged gadget use (Leong, 2024).

Additionally, wrist discomfort (35.4%)-though less prevalent than neck and back pain-remains an important finding, especially considering the rising trend of smartphone dependency. The repetitive movements required for scrolling, tapping, and typing on handheld devices lead to strain on wrist tendons and small hand muscles. Research has consistently shown that prolonged smartphone use, particularly in non-neutral wrist positions, increases the risk of tendinopathy, carpal tunnel syndrome, and general wrist fatigue. The findings of this study align with these established patterns and highlight the growing concern regarding upper extremity disorders in digital work environments.

The behavioral aspect of gadget use also plays a significant role in shaping musculoskeletal health outcomes. Many office workers are not consciously aware of their postures during work, often maintaining suboptimal positions for prolonged periods due to task demands, deadlines, or lack of ergonomic training. Only a minority of participants reported receiving formal ergonomic guidance, which indicates a substantial gap in workplace health promotion. When ergonomic knowledge is limited, workers may inadvertently adopt harmful habits-such as leaning forward excessively, holding smartphones at low angles, or failing to adjust chair height-leading to preventable

musculoskeletal strain. This deficiency highlights the importance of educational interventions that empower employees to recognize and modify their posture, adjust workstation components, and incorporate movement into their daily routines.

Moreover, the cross-cultural element of this study provides valuable insights into the universality of gadget-related musculoskeletal risks. Despite cultural, organizational, and environmental differences between Indonesia and China, both groups exhibited similar symptom patterns and prevalence rates. This suggests that the physical demands of modern digital work environments have become sufficiently standardized to affect workers across national boundaries. As technological integration becomes increasingly globalized, work patterns in various countries converge, leading to shared occupational health challenges. Thus, the study's cross-country design strengthens the generalizability of its findings and underscores the need for ergonomic interventions applicable to diverse workplace settings.

Beyond physical factors, the psychosocial dimension of work should also be considered. High workload, tight deadlines, and the expectation to remain digitally connected can pressure employees to use gadgets continuously without adequate breaks. Psychosocial stress is known to increase muscle tension, reduce pain tolerance, and exacerbate perceived discomfort, creating a cycle in which stress and musculoskeletal symptoms reinforce one another. Although this study focused primarily on physical exposure, the potential influence of psychosocial variables cannot be overlooked and should be addressed in future investigations.

Another important implication of this study is its relevance to contemporary work models. With the rise of hybrid work and remote office arrangements, many employees now work from home using makeshift or suboptimal workstations. Dining tables, beds, and couches are commonly used as workspaces, which further increase ergonomic risks. While this study evaluated office-based workers, the patterns identified may be even more pronounced in remote work environments, suggesting that risk levels could be underestimated if remote workers were included.

Despite the robust findings, several limitations must be acknowledged. The cross-sectional design limits causal inference, and reliance on self-reported data may introduce recall bias. Furthermore, factors such as physical activity level, workstation equipment quality, and chronic health conditions were not fully explored, though they may independently influence musculoskeletal symptoms. Nevertheless, the consistency of findings with existing literature strengthens confidence in the observed associations (Nasri et al., 2023).

Overall, the extended interpretation of results emphasizes that musculoskeletal complaints linked to gadget exposure are multifactorial and require a comprehensive approach for prevention. Effective strategies should combine ergonomic workstation improvements, periodic rest breaks, employee training, and organizational policies that encourage healthy digital habits. Moreover, future research should consider integrating longitudinal approaches and ergonomic intervention trials to assess long-term effects and practical solutions (Fadel et al., 2023).

Building on these findings, a deeper interpretation reveals that both biomechanical and behavioral mechanisms likely play major roles in the onset of these complaints. Prolonged static posture is known to increase muscle fatigue, reduce blood flow to soft tissues, and heighten the risk of microtrauma. When office workers maintain fixed positions for extended periods-such as leaning forward toward a computer screen or flexing the neck while using smartphones-the musculoskeletal system undergoes continuous stress (Goldsmith, 2024). Over time, this can lead to muscle imbalance, poor postural adaptations, and chronic pain. The observed association between longer gadget use (>6 hours/day) and higher musculoskeletal complaints aligns strongly with this theoretical framework and reinforces prior research suggesting that static loading is a critical contributor to work-related musculoskeletal dysfunction (Casjens et al., 2023).

Another important dimension highlighted in the findings is the role of ergonomic awareness and work habits. Logistic regression analysis identified poor ergonomic practices and lack of rest

breaks as significant predictors of musculoskeletal symptoms. This suggests that device-related discomfort is not solely caused by duration of use but also by how gadgets are used (Azmi & Aziz, 2022). Office workers who are unaware of proper posture, optimal screen height, chair design, and hand positioning may be more susceptible to strain injuries. The low proportion of participants who reported receiving ergonomic training (<40%) indicates a notable gap in workplace health promotion. This finding points toward the need for structured ergonomic programs that include training, workstation adjustments, and behavior modification strategies (Prasetya et al., 2024).

The comparative results between Indonesian and Chinese office workers further enrich the discussion. Despite cultural and organizational differences between the two countries, the similarity in prevalence rates suggests that gadget-related musculoskeletal risks transcend cultural boundaries (Motta et al., 2024). This is consistent with studies showing that digital work environments tend to standardize physical behaviors-such as sitting posture, keyboard use, and smartphone handling-regardless of regional background (Marzban et al., 2024). Thus, occupational health interventions may be broadly applicable across Asia, provided that minor cultural adaptations are incorporated to maximize acceptance and adherence.

From a psychosocial perspective, the findings can also be interpreted through the lens of occupational stress and workload demands. High work intensity, time pressure, and expectations for rapid digital communication may drive workers to remain engaged with gadgets for extended periods without sufficient rest (Demissie, 2024). This aligns with the psychosocial model of musculoskeletal disorders, which posits that psychological stress can amplify muscle tension, reduce recovery time, and worsen pain perception. Thus, addressing gadget exposure requires not only ergonomic improvements but also a holistic approach that considers workload distribution, organizational culture, and employee well-being (El Shunnar et al., 2024).

Moreover, the cross-sectional nature of the study provides insight into current trends but also highlights evolving workplace dynamics. With the increasing adoption of hybrid and remote work models, office workers may be exposed to even greater ergonomic risks due to informal home workstation setups. While the present study focuses on office-based employees, the implications are highly relevant for modern work environments where mobility and device flexibility often come at the expense of proper ergonomics. This suggests that future occupational health strategies must adapt to changing patterns of work and technology use (Gomez et al., 2023).

Despite the compelling findings, it is important to acknowledge the limitations of this study. The cross-sectional design restricts the ability to infer causality, and self-reported data introduce the potential for recall bias (. Additionally, factors such as physical activity levels, psychosocial stress, and pre-existing medical conditions were not explored in detail, although they may influence musculoskeletal outcomes. Nonetheless, the consistency of the results with global research trends strengthens the validity of the conclusions (Mao & Raju, 2025).

Overall, the findings emphasize an urgent need for workplace ergonomic interventions, policy changes, and educational programs to mitigate the impact of prolonged gadget use. Organizations should prioritize adjustable workstations, regular rest breaks, ergonomic training, and digital wellness policies. Meanwhile, future research should incorporate longitudinal designs to confirm causal relationships and evaluate the effectiveness of intervention strategies in reducing musculoskeletal complaints.

Conclusion

This study demonstrated a strong relationship between prolonged gadget exposure and musculoskeletal complaints among office workers in Indonesia and China. Neck, back, and wrist pain were the most prevalent symptoms associated with extended gadget use. Prolonged usage, poor ergonomics, and insufficient rest breaks were identified as key risk factors. These findings underscore

the importance of ergonomic interventions and organizational policies promoting healthy digital habits. Further research with longitudinal designs is recommended to establish causality and evaluate intervention effectiveness.

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