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The Impact of Workload on Musculoskeletal Disorders Among Financial Service Workers

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ABSTRACT
Background: Musculoskeletal disorders (MSDs) are among the most prevalent occupational health problems worldwide and have become a major concern among office workers. Employees in the financial service sector are exposed to prolonged sitting, repetitive computer tasks, and increasing workloads, all of which may contribute to the development of musculoskeletal disorders. Despite the growing number of studies on office ergonomics, evidence regarding financial service workers remains limited. Purpose: This study aimed to analyze the impact of workload on musculoskeletal disorders among financial service workers. Methods: A quantitative cross-sectional study was conducted involving 120 financial service employees selected through purposive sampling. Workload was measured using the National Aeronautics and Space Administration Task Load Index (NASA-TLX), while musculoskeletal complaints were assessed using the Nordic Body Map questionnaire. Descriptive statistics, chi-square tests, and logistic regression analyses were performed with a significance level of 0.05. Results: Workers with high workloads experienced a higher prevalence of musculoskeletal disorders compared with those with moderate workloads. Neck pain, shoulder pain, lower back pain, and wrist discomfort were the most frequently reported complaints. Statistical analysis revealed a significant relationship between workload and musculoskeletal disorders (p<0.05). Implications: Effective workload management and ergonomic interventions are necessary to minimize musculoskeletal problems and improve occupational health among financial service workers. Conclusion: Workload significantly affects the occurrence of musculoskeletal disorders among financial service workers.

INTRODUCTION

Musculoskeletal disorders (MSDs) represent one of the leading occupational health problems worldwide and are responsible for substantial economic losses, decreased productivity, absenteeism, and reduced quality of life among workers. According to the World Health Organization (WHO), approximately 1.71 billion people globally suffer from musculoskeletal conditions, making these disorders one of the most common causes of disability. Work-related musculoskeletal disorders are particularly prevalent among office employees who spend prolonged periods performing repetitive tasks while maintaining static postures.

The financial service sector has undergone significant transformation due to digitalization and increasing competition. Employees in banking, insurance, and other financial institutions are required to perform complex cognitive tasks while simultaneously handling administrative activities through computers. Such working conditions often involve prolonged sitting, repetitive hand movements, high visual demands, and considerable mental workload. Consequently, workers in this sector may be at an increased risk of developing musculoskeletal complaints, particularly in the neck, shoulders, lower back, and upper extremities.

Numerous studies have demonstrated that workload is an important determinant of musculoskeletal disorders. High workload may contribute to physical fatigue and increased muscle tension, thereby increasing the likelihood of pain and discomfort. In addition, excessive workload can elevate psychological stress, which has been shown to exacerbate musculoskeletal symptoms. Previous research among office workers, healthcare personnel, and industrial employees has consistently reported significant associations between workload and musculoskeletal disorders.

Although previous studies have examined the relationship between workload and musculoskeletal disorders, limited evidence is available regarding employees working in financial service institutions. The characteristics of financial service work differ from those of other occupations because they involve both physical and cognitive demands. Therefore, understanding the influence of workload on musculoskeletal disorders among financial service workers is essential for developing effective occupational health interventions.

This study aimed to analyze the impact of workload on musculoskeletal disorders among financial service workers. The novelty of this study lies in its focus on financial service employees and the simultaneous use of the NASA Task Load Index (NASA-TLX) and the Nordic Body Map questionnaire to evaluate workload and musculoskeletal complaints.

METHODS

1. Study Design and Population

This study employed a quantitative analytical approach with a cross-sectional design to analyze the impact of workload on musculoskeletal disorders (MSDs) among financial service workers. The target population consisted of all full-time office employees working at financial service institutions in the study region, with a total population size of $N = 170$ employees.

2. Sample Size and Sampling Technique

The required sample size was calculated using Slovin's formula to ensure statistical power and precision:

$$n = \frac{N}{1 + N(e)^2} \qquad (1)$$

Where N is the total population size (170) and e is the margin of error (0.05). Based on this calculation, the minimum required sample size was approximately 119.3, which was rounded up to 120 respondents to maintain robust data analysis.

Due to operational constraints, a non-probability purposive sampling technique was utilized to select the participants. To minimize selection bias and improve data reliability, strict eligibility criteria were applied. The inclusion criteria were: (1) full-time active employees, (2) minimum working experience of one year, and (3) willingness to participate voluntarily in the study. The exclusion criteria were: (1) employees with a history of congenital musculoskeletal deformities or severe traumatic physical injuries prior to employment, and (2) employees currently on medical or maternal leave during the data collection period. While purposive sampling was necessary for this study, it is acknowledged that non-probability sampling may limit the wider representativeness and generalizability of the samples. Therefore, future studies should consider employing probability sampling methods to enhance the generalizability of the findings to a broader financial sector population.

3. Variables and Operational Definitions

To minimize potential confounding effects and reduce bias, this study incorporated independent, dependent, and comprehensive control variables:

a. **Independent Variable (Workload)**
   Workload was subjectively measured using the National Aeronautics and Space Administration Task Load Index (NASA-TLX), which evaluates six dimensions: mental demand, physical demand, temporal demand, performance, effort, and frustration. The total score ranges from 0 to 100. In this study, the workload was categorized based on established cut-off scores: a score of 50–79 was classified as Moderate Workload, while a score of 80–100 was classified as High Workload.
b. **Dependent Variable (Musculoskeletal Disorders)**
   Musculoskeletal Disorders (MSDs) are operationally defined as work-related injury, damage, pain, or discomfort in the body's soft tissues—including muscles, tendons, ligaments, nerves, and joints—caused or aggravated by occupational tasks. MSD complaints were systematically assessed using the standardized Nordic Body Map (NBM) questionnaire, evaluating 28 specific body regions over the past 12 months, and dichotomized into "Yes" (presence of regular pain/discomfort) or "No" (absence of pain).
c. **Control Variables**
   To mitigate confounding bias during the design and analysis stages, two sets of control variables were integrated:
   1) **Individual Factors:** Age (categorized as < 35 or > 35 years), Gender (Male/Female), Working Period (< 5 or ≥ 5 years), Physical Activity Level (active/inactive based on routine exercise frequency), and Body Mass Index (BMI, calculated from self-reported height and weight).
   2) **Ergonomic Factors:** Ergonomic work postures (assessed via observations of static neck and back flexion during computer work) and workplace ergonomics (adequacy of chair adjustment, desk height, and monitor placement).

4. Data Analysis

Descriptive statistics were applied to outline the respondents' demographic characteristics, workload distribution, and MSD prevalence. Bivariate analysis using the Chi-square test (X^2) was performed to evaluate the baseline relationship between workload and MSDs. Subsequently, a multivariate logistic regression analysis was conducted, entering the individual and ergonomic control variables into the model to isolate the true impact of workload on MSDs by controlling for potential confounders. The level of statistical significance was established at a p-value < 0.05.

RESULTS

1. Characteristics of Respondents

A total of 120 financial service workers participated in this study. Female respondents accounted for 60.0% of the sample, while male respondents represented 40.0%. Most respondents were aged ≤35 years (65.0%) and had worked for more than five years (54.2%). These findings indicate that the majority of respondents were relatively young and had considerable working experience in the financial sector.

Table 1. Characteristics of Respondents (n = 120)

Characteristics	Frequency	Percentage (%)
Gender		
Male	48	40.0
Female	72	60.0
Age		
≤35 years	78	65.0
>35 years	42	35.0
Working Period		
<5 years	55	45.8
≥5 years	65	54.2

2. Distribution of Workload

Based on the NASA-TLX questionnaire, most respondents experienced high workloads (65.0%), whereas 35.0% reported moderate workloads.

Table 2. Distribution of Workload Among Financial Service Workers

Workload Category	Frequency	Percentage (%)
Moderate	42	35.0
High	78	65.0
Total	**120**	**100.0**

3. Prevalence of Musculoskeletal Disorders

The prevalence of musculoskeletal disorders among respondents was 70.0%. Only 30.0% of participants reported no musculoskeletal complaints.

Table 3. Prevalence of Musculoskeletal Disorders

Musculoskeletal Disorders	Frequency	Percentage (%)
Yes	84	70.0
No	36	30.0
Total	**120**	**100.0**

4. Logistic Regression Analysis of Workload and Musculoskeletal Disorders

Table 4 presents the relationship between workload and musculoskeletal disorders. Among respondents with high workloads, 63 individuals (80.8%) experienced musculoskeletal disorders, whereas only 21 workers (50.0%) with moderate workloads reported similar complaints.

To isolate the independent effect of workload on the occurrence of musculoskeletal disorders (MSDs), a multivariate logistic regression analysis was performed. This analysis controlled for individual factors (age, gender, working period, BMI, physical activity) and ergonomic factors (work posture, workstation adequacy).

Table 4 The Relationship Between Workload and Musculoskeletal Disorders

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Workload			
Moderate	1.00 (Ref)	–	–
High	4.25	1.85 – 9.76	0.001
Individual Control Factors			
Age (>35 vs ≥35 years)	1.42	0.62 – 3.24	0.402
Gender (Female vs Male)	1.65	0.71 – 3.82	0.245
Working Period (≥5 vs <5 years)	2.10	0.94 – 4.72	0.072
BMI (Overweight vs Normal)	1.22	0.51 – 2.90	0.658
Physical Activity (Inactive vs Active)	1.88	0.81 – 4.35	0.141
Ergonomic Control Factors			
Poor Work Posture (Yes vs No)	3.12	1.34 – 7.28	0.008
Inadequate Workstation (Yes vs No)	2.45	1.06 – 5.66	0.035

As shown in Table 4, after adjusting for all potential confounding variables, workload remained a highly significant and strong predictor of MSDs ($p = 0.001$). Financial service workers exposed to a high workload had 4.25 times higher odds of developing musculoskeletal disorders compared to those with a moderate workload (OR = 4.25; 95% CI = 1.85 – 9.76). Additionally, poor work posture (OR = 3.12; 95% CI = 1.34 – 7.28; $p = 0.008$) and inadequate workstation layout (OR = 2.45; 95% CI = 1.06 – 5.66; $p = 0.035$) were also found to be statistically significant ergonomic risk factors.

DISCUSSION

1. Comparison with Prior Studies and Analytical Explanations

The multivariate analysis in this study confirmed that workload is significantly associated with musculoskeletal disorders. Employees experiencing high workloads were found to have a 4.25-fold increase in MSD odds, even after rigorous adjustment for demographic and ergonomic control factors. This finding strongly aligns with previous research by Habibi et al. (2018) and Besharati et al. (2020), which reported that escalating subjective mental and physical demands among office employees correlate directly with severe localized muscle discomfort.

However, the strength of the association (OR = 4.25) observed in this financial service cohort is notably higher than that typically found in general office administrative workers (e.g., Cho et al.,

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2012). The potential reason for this disparity lies in the unique dual-demand characteristics of modern financial service work. Following rapid digitalization, bank and insurance workers handle complex, continuous cognitive computations while performing highly repetitive keyboard data entry tasks under strict time constraints. This compound effect intensifies physical tension far more than purely administrative roles.

Interestingly, while individual control factors such as age, gender, and long working periods (≥ 5 years) showed an upward trend in MSD risk (OR > 1.00), they did not reach statistical significance ($p > 0.05$). This indicates that within this specific population, the structural demands of the job (high workload and poor ergonomics) outweigh baseline biological differences. This reinforces the argument that MSDs in this sector are primarily driven by occupational design rather than unavoidable demographic predispositions.

2. Biological and Ergonomic Mechanisms

The underlying mechanism linking a high workload to MSDs can be explained through integrated neuro-muscular and psychophysiological pathways.

From an ergonomic standpoint, a high workload inherently reduces the frequency and duration of micro-breaks. Financial service employees under high temporal demand tend to maintain a static seated posture for hours to meet targets. Biomechanically, prolonged static sitting causes continuous low-level isometric contractions of the stabilizing muscles in the neck, shoulders, and lower back (such as the upper trapezius and erector spinae). This static load constricts local capillaries, restricts intramuscular blood flow, and accelerates local tissue hypoxia. Without adequate recovery breaks, the accumulation of metabolic waste products (such as lactic acid) triggers painful inflammation, manifesting as the frequently reported neck and lower back pain.

Biologically, high mental workload activates the sympathetic nervous system, inducing a generalized stress response. Chronic psychological stress elevates systemic cortisol and catecholamine levels, which increases baseline muscle tone (muscle tension) even during non-exertional tasks. This psychological amplification of muscle strain lowers the threshold for pain perception and accelerates the micro-tearing of muscle fibers, particularly in the wrist and upper extremities during repetitive computer use.

3. Practical Implications for Occupational Health

The findings of this study have direct, actionable implications for financial institutions aiming to mitigate occupational hazards and maintain workforce productivity:

a. Workload Optimization and Scheduled Micro-Breaks

Relying solely on physical adjustments is insufficient if workloads remain excessive. Management must implement algorithmic work-distribution frameworks to balance daily mental and administrative tasks. Furthermore, automated software triggers should be introduced to mandate 5-minute active stretching micro-breaks for every 50–60 minutes of continuous screen work, allowing tissues to reoxygenate.

b. Ergonomic Engineering and Participatory Ergonomics

Given that poor work posture (OR = 3.12) and inadequate workstations (OR = 2.45) were significant predictors, companies should invest in adjustable ergonomic infrastructure (e.g., customizable chairs, articulating monitor arms, and split keyboards). Employees should undergo participatory ergonomic training to adjust their workstations to match their anthropological profiles.

c. Comprehensive Wellness Screenings

Occupational health units within financial institutions should utilize the NASA-TLX and Nordic Body Map matrices as routine annual screening tools to identify high-risk employees early, preventing acute muscle strain from turning into chronic, debilitating occupational disabilities.

CONCLUSIONS

This study demonstrated that workload significantly affects musculoskeletal disorders among financial service workers. Employees exposed to high workloads experienced a greater prevalence of musculoskeletal complaints compared with those with moderate workloads. Neck pain, shoulder pain, lower back pain, and wrist discomfort were the most commonly reported symptoms. These findings suggest that workload management and ergonomic interventions are essential to prevent musculoskeletal disorders and improve occupational health among financial service workers.

To overcome the cross-sectional limitations of this study, future research should employ prospective cohort or longitudinal study designs to provide stronger, more definitive evidence of a causal relationship between workload dynamics and the development of musculoskeletal disorders over time. Furthermore, investigating a broader range of psychosocial and objective biomechanical risk factors would enhance the depth of future occupational health interventions.

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