Factors Associated with Physical Work Stress among Photocopy Workers around Universitas Muhammadiyah Surakarta

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Abstract.
Physical work stress among photocopy workers is an important occupational health issue, often arising from prolonged working duration, years of service, and work fatigue. Preliminary observations identified common symptoms among workers, including headaches, eye strain, and back pain, indicating the presence of physical stress related to job demands. This study aimed to analyze the relationship between years of service, daily working duration, and work fatigue with physical work stress among photocopy workers around Universitas Muhammadiyah Surakarta. This study employed a quantitative analytic cross-sectional design with a total sampling technique involving 56 photocopy workers. Data were collected using a self-administered questionnaire, including the Industrial Fatigue Research Committee (IFRC) instrument to measure work fatigue and a modified NIOSH questionnaire to assess physical work stress, and analyzed using the Spearman rank correlation test. The results showed that years of service were not significantly associated with physical work stress ($p = 0.539$; $r = -0.084$). In contrast, daily working duration had a significant positive relationship with physical work stress ($p = 0.001$; $r = 0.426$), indicating a moderate correlation. The strongest relationship was found between work fatigue and physical work stress ($p < 0.001$; $r = 0.823$), demonstrating a very strong positive correlation. In conclusion, work fatigue is the most dominant factor associated with physical work stress among photocopy workers; therefore, interventions should prioritize fatigue management and the optimization of working duration.

Keywords: *Work Stress; Work Fatigue; working duration; working hours and photocopy worker.*

I. INTRODUCTION

Work-related stress has become an increasingly important issue in modern occupational health due to its significant impact on workers' physical and psychological well-being. Stress is generally defined as a condition arising from the interaction between individuals and their work, particularly when job demands exceed their capacity to cope. Work stress occurs as a result of the interaction between workers and their job demands, leading to physical and psychological imbalances that can affect emotions, cognitive processes, and overall health [1]. Physical work stress specifically manifests through physiological symptoms such as fatigue, headaches, muscle tension, and decreased physical endurance, which may ultimately reduce productivity and work performance [2].

Globally, the burden of work-related stress is substantial. Data from the Health and Safety Executive reported approximately 595,000 cases of work-related stress, depression, or anxiety, with a prevalence of 1,800 cases per 100,000 workers. These conditions accounted for 44% of all work-related health problems and contributed to 57% of sickness-related absenteeism [3]. This evidence indicates that work stress is not only a personal health issue but also an organizational concern due to its association with decreased productivity, increased absenteeism, and economic losses [4].

Work stress is influenced by multiple factors, including individual and job-related characteristics. Individual factors such as age, gender, and years of service (tenure) may affect a worker's ability to adapt to job demands. Workers with longer tenure tend to have more experience and better coping strategies; however, prolonged exposure to the same work conditions may also lead to boredom and fatigue. In addition, job-related factors such as long working hours are strongly associated with increased stress [5]. Working beyond the normal limit of 6–8 hours per day can lead to fatigue, reduced efficiency, and higher risk of stress and occupational health problems [6]. Empirical studies have confirmed a significant relationship between long working hours and work stress [7].

Another important factor contributing to work stress is work fatigue. Fatigue is a protective physiological response indicating decreased physical and mental capacity due to prolonged work demands [8]. High levels of fatigue can impair concentration, reduce productivity, and increase vulnerability to stress-related conditions. Previous studies have demonstrated a significant relationship between work fatigue and

work stress across different occupational settings [9], highlighting fatigue as a key determinant of physical work stress.

In the informal sector, work stress remains an underexplored issue despite its high relevance. Photocopy workers represent a vulnerable group due to the nature of their work, which is repetitive, physically demanding, and often involves prolonged standing and continuous customer interaction. These workers frequently face unpredictable workloads, especially during peak academic periods, requiring them to work long hours with minimal rest. In addition, customer demands for fast and accurate service create time pressure that may exacerbate stress levels. Ergonomic risks, such as repetitive movements and static postures, further contribute to physical discomfort and stress among photocopy workers [10].

Preliminary observations conducted among photocopy workers around Universitas Muhammadiyah Surakarta (UMS) revealed common complaints such as headaches, eye strain, and back pain. These symptoms were mainly associated with long working hours, high workload variability, and insufficient rest. Workers often reported working up to 12 hours per day, which may disrupt work-life balance and increase both physical fatigue and stress levels. Such conditions indicate that photocopy workers are at considerable risk of experiencing physical work stress.

Despite the recognition of these contributing factors, there is still limited research focusing specifically on physical work stress among photocopy workers, particularly in informal sector settings. Previous studies have primarily examined formal occupations, leaving a gap in understanding how tenure, working hours, and work fatigue interact to influence physical stress in this population. Therefore, this study aims to identify the relationships between years of service, working hours, and work fatigue with physical work stress among 56 photocopy workers around Universitas Muhammadiyah Surakarta. By addressing this gap, the findings are expected to contribute to the development of effective strategies to reduce work stress and improve the occupational health and well-being of informal workers.

II. METHODS

This study employed a quantitative analytic design with a cross-sectional approach to examine the relationships between years of service, working hours, and work fatigue with physical work stress among photocopy workers. The research was conducted from January to February 2025 in photocopy businesses located around Universitas Muhammadiyah Surakarta (UMS), specifically in the areas of Jalan Duwet Raya, Jalan Mendungan, Jalan Garuda Mas, Jalan Gatak, Jalan Gatak 1, and Jalan Menco Raya, which are administratively part of Desa Pabelan, Kecamatan Kartasura, Kabupaten Sukoharjo. This setting was selected due to the high concentration of photocopy services supporting academic activities, resulting in a dynamic and potentially demanding work environment.

The study population consisted of all photocopy workers operating within the defined study area, totaling 56 individuals across 31 photocopy businesses. Given the relatively small population size, a total sampling technique was applied, whereby all eligible workers were included as respondents. Inclusion criteria comprised active photocopy workers present at the time of data collection and willing to participate in the study. This approach ensured comprehensive coverage of the target population and minimized sampling bias.

The study variables included three independent variables and one dependent variable. The independent variables were years of service, working hours, and work fatigue. Years of service were defined as the duration of time that a respondent had worked as a photocopy worker and were treated as an ordinal variable. Working hours referred to the number of hours worked per day and were also treated as an ordinal variable reflecting daily work duration. Work fatigue was assessed using the Industrial Fatigue Research Committee (IFRC) questionnaire, which consists of 30 items designed to capture subjective fatigue symptoms across physical, cognitive, and motivational dimensions. The dependent variable was physical work stress, defined as the physiological response to work-related pressures experienced by photocopy workers. This variable was measured using a questionnaire based on the National Institute for Occupational Safety and Health (NIOSH), consisting of 15 items that assess various physical symptoms associated with work stress.

Data were collected using primary data through self-administered questionnaires. Prior to data collection, respondents were informed about the study objectives, procedures, and their rights as participants. Informed consent was obtained from each respondent to ensure voluntary participation. The questionnaires were distributed directly to respondents at their workplaces in a conducive setting to facilitate accurate and honest responses. During the data collection process, the researcher and assistants were present to provide clarification if needed, thereby minimizing potential misunderstandings and improving data validity.

Data processing was conducted systematically through several stages. Initially, data editing was performed to check for completeness, consistency, and accuracy of the responses. This was followed by coding, where each variable and response category was assigned numerical codes to facilitate analysis. Scoring procedures were applied to the IFRC and NIOSH instruments by aggregating responses to obtain overall measures of work fatigue and physical work stress. Subsequently, tabulating was carried out to organize the data into structured tables for analysis.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS). Univariate analysis was conducted to describe the distribution of each variable, including frequencies and percentages. Bivariate analysis was then applied to examine the relationships between independent variables (years of service, working hours, and work fatigue) and the dependent variable (physical work stress). The Spearman rank correlation test was used due to the ordinal nature of the data and the non-parametric distribution. Statistical significance was determined at a p-value of less than 0.05. A p-value below this threshold indicated a statistically significant relationship between variables, while a p-value equal to or greater than 0.05 indicated no significant association.

III. RESULT AND DISCUSSION

Univariate Analysis

Table 1. Respondent Characteristics

Respondent Characteristics	Amount	percentage (%)
Age		
17-22	12	21,43 %
23-29	22	39,29 %
30-35	11	19,64 %
36-41	7	12,50 %
42-47	4	7,14 %
Level of education		
Junior High School	4	7,14 %
Senior High School	46	82,14 %
Higher Education	6	10,71 %
Years of service		
≤ 5 years	34	60,71 %
> 5 years	22	39,29 %
Working duration		
≤ 8 hours/day (Normal)	17	32,14 %
> 8 hours/day (Overwork)	39	67,86%
Level of Work Fatigue		
Not fatigued	0	0 %
Mild fatigued	23	41,1 %
Moderate fatigued	33	58,9 %
Severe fatigued	0	0 %

Level of physical Work Stress		
Low	23	41,1 %
Moderately low	6	10,7 %
Moderately high	25	44,6 %
High	2	3,6 %

Based on Table 1, the largest proportion of respondents was in the 23–29-year age group, comprising 22 individuals (39.29%), indicating that the workforce is predominantly within the early to middle stages of productive age. In terms of educational attainment, the majority of respondents had completed senior high school or its equivalent (82.14%), reflecting a moderate level of formal education. Most respondents also had relatively shorter work experience, with 60.71% reporting a tenure of five years or less. Additionally, a substantial proportion of respondents (69.64%) reported working more than eight hours per day, indicating the dominance of extended working hours among photocopy workers in the study area.

In line with these characteristics, the distribution of work fatigue and physical work stress levels shows a consistent pattern, where the majority of respondents experienced moderate fatigue (33 individuals; 58.9%) and were predominantly categorized as having moderately high physical work stress (25 individuals; 44.6%). This finding suggests that the workforce profile characterized by relatively young age, shorter work experience, and prolonged working hours may contribute to the concentration of fatigue and stress within the moderate range, indicating a potential alignment between the prevalence of fatigue and elevated physical work stress among the study population.

Bivariate Analysis

Table 2. Bivariate Analysis of Factors Associated with Physical Work Stress

Years of service	Physical Work Stress				Total	*P-value*	r
	Low	Moderately low	Moderately high	High			
≤ 5 years	13	4	15	2	*34*		
> 5 years	10	2	10	0	*22*	0,539	-0,084
Total	23	6	25	2	*56*		
Working duration	**Physical Work Stress**				**Total**	***P-value***	**r**
	Low	Moderately low	Moderately high	High			
Normal	11	4	2	0	17		
Overwork	12	2	23	2	39	**0,001**	0,426
Total	23	6	25	2	56		
Work Fatigue	**Physical Work Stress**				**Total**	***P-value***	**r**
	Low	Moderately low	Moderately high	High			
Not fatigued	0	0	0	0	0		
Mild fatigued	20	3	0	0	23		
Moderate fatigued	3	3	25	2	33	**0,000**	0,823
Severe fatigued	0	0	0	0	0		
Total	23	6	25	2	56		

The results of the Spearman rank correlation test indicate differing relationships among the studied variables. Years of service showed no statistically significant association with physical work stress ($p = 0.539$; $r = -0.084$), with a very weak negative correlation. In contrast, working duration demonstrated a significant moderate positive relationship with physical work stress ($p = 0.001$; $r = 0.426$), where respondents with longer working hours were more frequently categorized as experiencing moderately high stress compared to those with shorter durations, who were mostly in the low stress category. The strongest

relationship was observed between work fatigue and physical work stress ($p < 0.001$; $r = 0.823$), indicating a very strong positive correlation.

IV. DISCUSSION

Years of service in this study were defined as the duration of time respondents had worked as photocopy workers, categorized into ≤5 years and >5 years. Years of service not only represent the length of employment but are also associated with an individual's ability to adapt to job demands and the work environment. Previous studies have indicated that years of service are closely related to the adjustment process between workers and their jobs, including the ability to cope with workload and environmental conditions [11]. Theoretically, the longer an individual works, the more developed their physical and psychological adaptation patterns become in response to routine activities. In this context, work experience plays an important role in enhancing an individual's adaptive capacity to various workplace dynamics and pressures [12].

However, based on the results of the Spearman rank correlation test in this study, a p-value of 0.539 and a correlation coefficient of $r = -0.084$ were obtained, indicating that there is no significant relationship between years of service and the level of physical work stress. These findings suggest that although years of service are associated with the adaptation process, in the context of photocopy work which is characterized by routine and repetitive tasks such adaptive capacity does not significantly influence the level of physical stress experienced by workers.

These results are consistent with previous research showing that years of service are not significantly associated with work stress [13]. In that study, conducted among home industry garment workers, the nature of the work shared similarities with photocopy work, as both involve repetitive activities, prolonged static postures, and relatively monotonous tasks. In occupations with homogeneous and minimally variable task patterns, exposure to physical workload tends to remain consistent over time, regardless of whether workers have shorter or longer tenure.

In addition, another study also reported similar findings, indicating no significant relationship between years of service and work stress [14]. The study emphasized that work climate factors had a more substantial impact on stress levels. This finding reinforces the understanding that in occupations with stable and continuous exposure to risk factors, years of service are not the primary determinant of stress. Instead, actual working conditions and daily environmental factors play a more prominent role in triggering stress responses among workers.

Shifting from length of employment to daily work patterns, working duration emerges as a more influential factor. In this study, working duration was defined as the number of hours worked per day, categorized into ≤8 hours (normal) and >8 hours per day (overwork). Conceptually, exceeding normal working hours increases the risk of physical work stress due to the accumulation of physical and mental workload beyond the body's recovery capacity. When individuals work for prolonged periods, particularly under conditions of overwork, the body may experience decreased stamina, fatigue, impaired concentration, and slower physiological responses. These conditions reflect an increased physiological burden which, over time, may develop into physical work stress [15].

The results of the Spearman rank correlation test in this study showed a p-value of 0.001 with a correlation coefficient of $r = 0.426$. These findings indicate a statistically significant relationship with a moderate strength and a positive direction between daily working duration and the level of physical work stress. This suggests that the longer photocopy workers spend working each day, the higher the level of physical stress they tend to experience. Therefore, daily working duration can be considered an important determinant influencing workers' physiological conditions.

This finding is consistent with previous research demonstrating that long working hours are significantly associated with increased health risks, including chronic fatigue and work-related physical disorders [16]. Irregular or excessive working hours, particularly in shift systems or conditions of overwork, may disrupt sleep patterns by reducing sleep quality, increasing nighttime awakenings, and shortening

overall sleep duration. Such disturbances hinder optimal physiological recovery, resulting in workers starting the next workday in a state of incomplete recovery [17].

In the context of photocopy workers around Universitas Muhammadiyah Surakarta, working more than 8 hours per day under conditions of overwork prolongs exposure to static standing positions, repetitive upper limb movements, and continuous customer service demands. These activities, when performed over extended durations without adequate rest management, can increase muscle tension, fatigue, and ultimately contribute to physical work stress.

Although the strength of the relationship falls within the moderate category, these findings provide empirical evidence that daily working duration is a meaningful contributing factor to physical work stress. Thus, the second hypothesis in this study is supported. This result underscores the importance of regulating working hours and implementing effective rest management strategies as preventive measures to maintain the physical health of informal sector workers, particularly in occupations characterized by repetitive work patterns such as photocopy services.

Building upon these findings, work fatigue appears as the most critical factor shaping physical work stress. The results demonstrate a very strong and statistically significant relationship between work fatigue and physical work stress ($p = 0.000$; $r = 0.823$), indicating that fatigue is not merely a concurrent condition but a primary determinant of stress. Conceptually, work fatigue is defined as a condition of exhaustion and frustration resulting from continuous job demands that exceed an individual's capacity to adapt and recover, thereby affecting physical, emotional, and mental balance [18]. This condition is not only characterized by decreased energy levels but also by impaired concentration, reduced motivation, and diminished work performance, with decreased concentration being one of the most dominant aspects. The decline in the ability to maintain focus increases the risk of errors and even occupational accidents [19]. In addition, work fatigue may be accompanied by psychosomatic complaints such as lethargy, sleep disturbances, and emotional instability, which, over time, can develop into more serious health problems and reduce overall work performance [20].

These findings are consistent with previous research demonstrating a significant relationship between work fatigue and work stress [21]. Similar results have also been reported in other studies, which found a meaningful association between stress and fatigue [22]. These studies highlight that demanding working conditions such as continuous physical exertion, excessive workload, frequent overtime, shift systems, and limited rest periods contribute to the acceleration of fatigue. When such conditions persist over time, workers become increasingly vulnerable to fatigue, which ultimately contributes to higher levels of work stress.

Further evidence from studies on manual labor sectors also supports these findings. Research has shown that work fatigue is significantly associated with work stress and can act as a dominant influencing factor [23]. Workers experiencing higher levels of fatigue tend to report higher levels of stress compared to those with lower fatigue levels. This pattern is consistent with the results of the present study, where respondents with higher fatigue levels were more likely to fall into higher categories of physical work stress.

In addition, other studies have demonstrated that work stress is significantly associated with multiple dimensions of fatigue, where increased job demands directly contribute to both physical and mental exhaustion [24]. It has also been reported that unfavorable working conditions and high levels of stress contribute to the development of chronic fatigue, which subsequently impacts workers' health and functional capacity [25]. The consistency of findings across these studies suggests a common underlying mechanism in which fatigue and work stress are closely interrelated. Specifically, the accumulation of workload without adequate recovery leads to fatigue, which then progresses into physical work stress. This alignment of findings indicates that fatigue and work stress operate within a closely linked mechanism, where excessive workload that exceeds the body's recovery capacity leads to simultaneous physical and psychological strain. Therefore, work fatigue can be positioned as a key determinant that reinforces the occurrence of physical work stress across various occupational sectors, including informal jobs characterized by high manual workload.

The correlation coefficient for work fatigue (r = 0.823) is substantially higher than that of working duration and years of service, indicating that fatigue is the most dominant factor associated with physical work stress among photocopy workers around Universitas Muhammadiyah Surakarta. Thus, the third hypothesis of this study is strongly supported, both statistically and conceptually. These findings emphasize that efforts to prevent physical work stress should primarily focus on controlling and managing work fatigue as a central priority.

V. CONCLUSION

Based on the findings of this study, it can be concluded that years of service do not have a significant relationship with physical work stress among photocopy workers, indicating that the length of work experience is not a primary factor in determining the level of physical stress. In contrast, daily working duration shows a significant relationship with physical work stress, where longer working hours are associated with higher levels of stress due to the accumulation of physical workload and insufficient recovery time. Among all variables examined, work fatigue demonstrates the strongest and most significant relationship with physical work stress, indicating that it is the dominant factor influencing this condition. Work fatigue, resulting from continuous and high job demands, contributes substantially to the development of physical stress through reduced physiological capacity and disturbances in both physical and psychological functioning. Therefore, efforts to control physical work stress among photocopy workers should primarily focus on managing work fatigue and optimizing daily working duration.

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