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Factors Contributing to Work Fatigue Among Construction Workers

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ABSTRAK

Sektor konstruksi merupakan salah satu sektor pekerjaan dengan tingkat risiko bahaya yang tinggi. Kegiatan yang dilakukan oleh pekerja konstruksi ini dapat menyebabkan terjadinya kesalahan dan kecelakaan kerja yang dipengaruhi oleh kelelahan. Tujuan dari penelitian ini adalah untuk memahami faktor-faktor yang berkaitan dengan kelelahan kerja pada pekerja konstruksi di Proyek Sistem Pengelolaan Air Minum. Metode penelitian yang digunakan adalah explanatory study dengan desain cross-sectional, dengan jumlah sampel sebanyak 30 orang yang diambil menggunakan teknik total sampling. Data primer dikumpulkan melalui penyebaran kuesioner baku yaitu Subjective Self Rating Test dan Depression Anxiety Stress Scales (DASS) 42. Data dianalisis secara univariat menggunakan uji distribusi frekuensi, analisis bivariat dengan uji Chi-Square dan data di visualisasikan menggunakan aplikasi Tableau Public 2022. Dari hasil penelitian didapatkan bahwa usia (p=0.104), pendidikan (p=0.419), dan lama kerja (p=0.063) tidak berhubungan dengan kelelahan kerja, sedangkan status gizi (p=0.042) dan stres kerja (p=0.028) memiliki hubungan dengan kejadian kelelahan kerja. Kesimpulan penelitian yaitu status gizi dan stres kerja berhubungan dengan kelelahan kerja pada pekerja konstruksi di Proyek Sistem Pengelolaan Air Minum. Saran kepada penyelenggara proyek, perlu dilakukan manajemen dan coping stres yang efektif kepada para pekerja untuk mengurangi kelelahan kerja dan menjaga status gizi pekerja dengan memberikan makanan sesuai kebutuhan kalori pekerja.

Kata kunci: *Konstruksi, Kelelahan Kerja, Proyek Pengelolaan Air Minum, Tingkat Stres, Status Gizi*

ABSTRACT

The construction sector is one of the work sectors with a high level of risk of danger. The activities carried out by construction workers can cause errors and work accidents which are influenced by fatigue. This research aims to understand the factors related to work fatigue in construction workers in the Drinking Water Management System Project. The research method used was an explanatory study with a cross-sectional design, with a total sample of 30 people taken using a total sampling technique. Primary data was collected by distributing standard questionnaires, namely the Subjective Self Rating Test and Depression Anxiety Stress Scales (DASS) 42. Data were analyzed univariately using the frequency distribution test, bivariate analysis using the Chi-Square test, and data were visualized using the Tableau Public 2022 application. From the results, the research found that age (p=0.104), education (p=0.419), and length of work (p=0.063) were not related to work fatigue, while nutritional status (p=0.042) and work stress (p=0.028) were related to the incidence of work fatigue. The research conclusion is that nutritional status and work stress are related to work fatigue in construction workers in the Drinking Water Management System Project. Suggestions to project organizers, it is necessary to carry out effective stress management and coping for workers to reduce work fatigue and maintain workers' nutritional status by providing food according to workers' calorie needs.

Keywords: *Construction, Work Fatigue, Drinking Water Management Project, Stress Level, Nutritional Status*

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I. INTRODUCTION

The construction industry is one of the most hazardous employment sectors. This is due to its interdisciplinary nature, the vast number of workers, restricted working duration, high work intensity, and different work equipment.[1] Workplaces must prioritize workplace safety and health. Efforts must be made to decrease and avoid the incidence of workplace accidents and occupational illnesses that harm employees.1 Fatigue is one of the leading causes of workplace mistakes and accidents.[2,3] The World Health Organization has officially characterized occupational fatigue as a concern.[4] Work-related

fatigue is officially classified as a work-related illness.[5,6]

In 2016, 1.9 million individuals died from work-related diseases and injuries worldwide.[7] According to the International Labor Organization, over 340 million work accidents occur yearly, and 160 million people suffer from job-related disorders.[8] Badan Penyelenggara Jaminan Sosial (BPJS) Ketenagakerjaan recorded that the number of work accidents in Indonesia was 265,334 cases in 2022. This number increased by 13.26% from the previous year which amounted to 234,270 cases.[9] In terms of occupational illnesses, there were 53 reported in 2020. From January to September 2021, there were 179 incidents of work-related illnesses.[10] In D.I Yogyakarta Province in 2020, there were 131 incidents of work accidents and 0 occurrences of occupational sickness.[11]

Fatigue is a sub-health state linked with persistent stress, limited resources, low skill, and a chronic lack of energy and enthusiasm for work. This disorder is characterized by emotional fatigue, depersonalization, and a lack of personal fulfillment.[12,13] Fatigue causes physical work fatigue, such as feeling weary and having physical tension symptoms (headaches, nausea, loss of sleep, and changes in eating patterns). Fatigue may also cause emotional fatigue by causing boredom or indifference, a loss of influence and pessimism, cynicism and hostility, depression-like emotions (sad faces, slumped postures), worry, irritation, and melancholy.[14]

Internal and environmental variables impact work fatigue. Age, gender, dietary status, exercise habits, and health issues are all internal influences. Job environment, work experience, workload, and length of service are examples of external influences.[15,16] According to prior studies, work fatigue is impacted by various factors, including working hours, work shifts,[17] job stress, degree of education, work experience,[18] age, and nutritional status.[19]

The Yogyakarta Drinking Water Supply System Management Improvement Agency oversees the Drinking Water Management System (DWMS) project. Although this development activity in the construction industry has been ongoing for only a few months, workers are still adapting to the work environment, equipment, and other relevant factors. Examples of activities that may induce work fatigue and contribute to workplace accidents include hot working conditions and intense physical exercise.

This research provides updated insights into the construction of drinking water management project systems, encompassing research locations. Additionally, it involves the measurement of general stress levels using the DASS 42 questionnaire, with variables grouped based on references. Data processing involves statistical analysis using data processing applications, complemented by visualization applications.

The outcomes of this research have the potential to make valuable contributions to the construction sector, specifically within the field of drinking water management systems. Consequently, this study aims to identify elements contributing to work fatigue among construction workers.

II. METHOD

This study employed explanatory research with a cross-sectional design to evaluate the factors associated with work fatigue in construction workers.[20] In April 2023, the research was conducted at the Drinking Water Management System (DWMS) Project in Yogyakarta Province. Thirty employees worked on the Water Treatment Installation project. The study included 30 participants as samples, employing total sampling as the sampling strategy.

Researchers collected primary data by distributing questionnaires. The independent factors are age, education, length of employment, nutritional status, and stress levels. In research, the dependent variable is work fatigue.

This study used a standard questionnaire, the Subjective Self Rating Test for work fatigue with 30 questions,[21] and Depression Anxiety Stress Scales (DASS) 42 are utilized to measure the level of stress. This questionnaire comprises three sections, namely depression, anxiety, and stress. In this research, emphasis is placed on the stress questionnaire, which consists of 14 questions (Numbers 1, 6, 8, 11, 12, 14, 18, 22, 27,

29, 32, 33, 35, 39) with a response range of 0-3,[22] no validity or reliability tests were performed.

The age questionnaire includes questions on workers' ages, divided into three categories: 15-24 years, 25-54 years, and 55-64 years[23], then simplified into 2 categories, namely productive and less productive. The education questionnaire asks employees about their most recent level of education, which is divided into four categories: less than basic (not attending school), basic (elementary school and junior high school), intermediate (high school), and advanced (further education)[24], then simplified into 2 categories, namely low (no school-junior high school) and high (high school-university). The work experience questionnaire includes questions on the work experience or years of service of a construction worker, classified as one year, 1-5 years, 6-10 years, and > ten years[25], then simplified into 2 categories, namely ≥ 10 years and >10 years.

The nutritional status questionnaire, which contains questions about the last worker's weight and height, is measured and confirmed by direct measurement with digital scales and measuring tape or meter, which is then calculated by the worker's Body Mass Index (BMI), with the BMI category following WHO standards, namely Underweight (18.5), Normal (18.5-24.9), Overweight (25-29.9), Obes Class 1 (30-34.9), Obes Class II (35-39)[6], then simplified into 2 categories, namely normal and abnormal. The Frequency Distribution test determines the distribution per variable, whereas the Chi-Square test or Fisher's exact test is used in bivariate analysis so that the study variables are separated into two groups. To ensure its validity, the chi-square test requires precise parameters. It is critical for a 2x2 tabulation that there are no predicted counts fewer than 5. Furthermore, each study subject should only be used for analysis once. The Yates Correction (Continuity Correction) is used when the 2x2 tabulation meets the chi-square conditions.[26]

If these requirements are not met, an alternate test, known as Fisher's exact test, is applied.[26] In the course of this study, the Fisher exact test was employed due to non-compliance of the data processing results with the requirements of the chi-square test. The Tableau Public 2022 program is used for data visualization.

III. RESULT AND DISCUSSION

Table 1. Characteristics of Workers

Characteristics of Respondents	n (%)	Mean	Std. Deviasi
Age (Year)			
15-24	3 (10)		
25-54	22 (73.3)	40.80	13.527
55-64	5 (16.7)		
Education Level			
Less than Basic	1 (3.3)		
Basic	20 (66.7)	1.37	0.718
Intermedediate	6 (20)		
Advance	3 (10)		
Body Mass Index			
Underweight	4 (13.3)		
Normal	20 (66.7)		
Overweight	6 (20)	22.07	3.45
Obes Class 1	0 (0)		
Obes Class 2	0 (0)		
Obes Class 3	0 (0)		
Work Experience			
<1 year	3 (10)		
1-5 year	3 (10)	14.37	11.15
6-10 year	7 (23.3)		
>10 year	17 (56.7)		
Level of Stress			
Normal	20 (66.7)		
Mild	2 (6.7)		
Moderate	5 (16.7)	11.13	9.265
Severe	2 (6.7)		
Very Severe	1 (3.3)		
Work Fatigue			
No Fatigue	1 (3.3)		
Mild	18 (60)	52.10	13.265
Moderate	11 (36.7)		
Severe	0 (0)		

Table 1 shows that the majority of respondents were aged 25-54 years, with an average age of 41 years, with a Basic education level (1.37) namely SD-SMP, normal nutritional status at an average BMI of 22.07, work experience with an average of 14 years old, normal stress level with an average score of 11.13, and mild work fatigue with an average score of 52.10.

In the next data processing stage, the information will be consolidated into two categories. This simplification aims to simplify analysis using the Chi-square test or Fisher exact test, in accordance with the requirements

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described in the research method. In accordance with the results of data processing, the test that will be used is the Fisher exact test. The results of data processing can be seen in tables 2 and 3.

According to Figures 1 and 2, the average construction worker had a light level of job stress at a productive age, more than ten years of work experience, normal nutritional status or BMI, and a mild work fatigue level of 8 persons, or 26.67%.

Table 2. Characteristics Respondents in Two Categories

Characteristics of Respondents	n (%)	Min	Max	Varians
Age (Year)				
Productive (25-54)	22 (73.3)	19	69	182.9
Less Productive (15-24 and 55-64)	8 (26.7)			
Education Level				
Low	21 (70)	0	3	0.516
High	9 (30)			
Work Experience				
≤10 year	11 (36.7)	0.1	40	124.5
>10 year	19 (63.3)			
Body Mass Index				
Normal	21 (70)	15.2	29.4	11.9
Abnormal	9 (30)			
Level of Stress				
Mild	22 (73.3)	0	36	85.8
Severe	8 (26.7)			
Work Fatigue				
Mild	19 (63.3)	30	73	175.9
Severe	11 (36.7)			

Tabel 2 displays that the average age of productive workers is 73.3%, with the minimum age being 19 years and the maximum age reaching 69 years. The average educational level falls into the low category (no schooling to first-level secondary education) at 70%. The average work experience exceeds 10 years, accounting for 63.3%, with the minimum work experience being 1 month and the maximum reaching 40 years. On average, workers have a normal nutritional status, amounting to 70%, with the minimum BMI being 15.2 and the maximum BMI being 29.4%. In terms of stress levels dan work fatigue, it is observed that the average worker experiences mild stress, accounting for 22%, and 63.3% of workers experience mild fatigue.

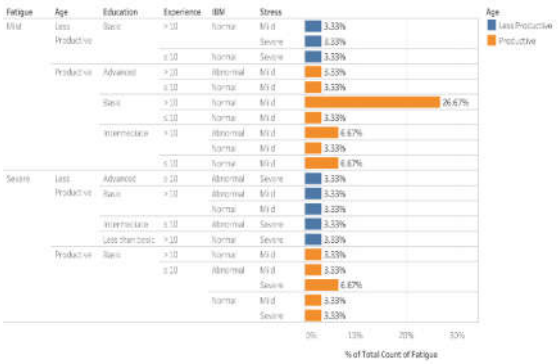

Figure 1. Count of Work Fatigue broken down by Variable

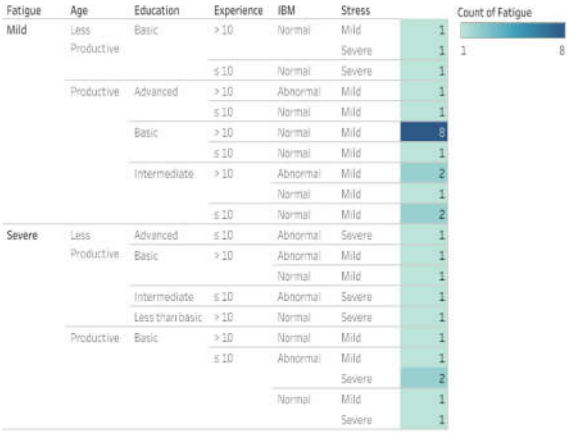

Figure 2. % of Total Count of Fatigue for each Variable

Table 3 shows the findings of the bivariate analysis. BMI (nutritional status) and stress levels were shown to be associated with work fatigue in construction workers.

Table 3. Bivariate Analysis of Factors Contributing to Work Fatigue

Variable	Work Fatigue			P value	Fh
	Mild n (%)	Savere n (%)	Total n (%)		
Age (Year)					
Productive	6 (20)	16 (53.3)	22 (73.3)	0.104	2.93
Less Productive	5 (16.7)	3 (10)	8 (26.7)		
Education Level					
Low	9 (30)	12 (40)	21 (70)	0.419	3.30
High	2 (6.7)	7 (23.3)	9 (30)		
Work Experience					
≤10 year	7 (23.3)	5 (16.7)	12 (40)	0.063	4.40
>10 year	4 (13.3)	14 (46.7)	18 (60)		
Body Mass Index					
Abnormal	6 (20)	3 (10)	9 (30)	0.042*	3.30
Normal	5 (16.7)	16 (53.3)	21 (70)		
Level of Stress					
Mild	6 (20)	2 (6.7)	8 (26.7)	0.028*	2.93
Savere	5 (16.7)	17 (20)	22 (73.3)		

Younger workers report higher job stress and work-family conflict levels than older workers.[27] As employees age, new work-family

conflict occurs, such as caring for elderly relatives, related to fatigue. Fatigue symptoms varied greatly depending on the life phases of working men and women, with younger men and women aged 20-35 and 55 years and older being more sensitive.[28] This study is comparable to that of Hiestand et al., who found no link between age and the occurrence of work fatigue.[29] The findings of Triana et al. vary in that there is a link between age and work fatigue with a p-value of 0.009.[30] This finding differs from the findings of Dall'Ora et al., who discovered that workers who are young and have significant work-life issues had a greater prevalence of fatigue.[31]

The results of this study have no association between education level and fatigue in construction workers. The amount of education influences construction workers' perceptions of occupational health hazards and directly affects coping behavior.[32] The amount of education is associated with the prevalence of work-related stress, and stress can produce fatigue, one of which is caused by role overload.[33,34] Higher levels of education may result in increased employment expectations and responsibilities, increasing the risk of fatigue.[35] Workers with a greater degree of education may have higher job expectations and may invest more in their employment, which can contribute to increased stress and fatigue.[36] Other study indicates that workers with a higher education degree may have better abilities and resources to deal with workplace stress, lowering the likelihood of work fatigue.[36,37] According to Obeid et al., education level was not connected to emotional and physical work fatigue with a p-value greater than 0.05.[38] Sun et al.'s study yielded different results, which found a link between education level and work fatigue.[39]

In this study, the work experience had no significant link with work fatigue among construction workers. However, experience may shield older workers against the risk of accidents associated with the job's high work speed and physical demands.[40] Furthermore, work experience might influence a construction practitioner's career, resulting in varied work content and duties.[41] Fatigue is connected with increased job demands regarding psychological well-being and work effort.[42] Professionalization can help construction workers avoid work fatigue by providing them with identity, autonomy, and competence. Construction worker with more excellent experience may be more inclined to accept more job demands and duties, which can raise their workload and stress levels and contribute to fatigue.[43] Work experience can increase workload, leading to increased stress and fatigue. Work experience can also contribute to a reduced workload, affecting employee job satisfaction.[44] This study contradicts Zhang et al.'s claim that job experience is connected to work fatigue.[45] However, according to the research of Ruiz-Fernández et al., there is a link between work experience and work fatigue.[46]

In this study, nutritional status was not related to work fatigue among construction workers. One of the causes of fatigue has been identified as inadequate nutrition. Food consumption and body composition changes appear to alter work fatigue perception, presumably through inflammation and mitochondrial dysfunction processes.[47] BMI is one variable that impacts work fatigue, with a greater BMI associated with more fatigue.[48] Workers with an aberrant nutritional state, such as underweight, may feel job fatigue. A study of construction workers discovered that workers who are tired at work are more likely to have irregular nutritional conditions.[49] Obesity and a high physical workload are linked to poor job performance and have a synergistic, negative effect.[49] It was discovered in Yamin et al.'s study that dietary status or body mass index did not influence the occurrence of work fatigue.[50] This study contradicted the findings of Załuski and Makara-Studzińska, who discovered a link between BMI and work fatigue.[51]

According to this study, stress levels have a meaningful association with work fatigue. Construction workers suffer from high levels of work fatigue because they labor in physically and intellectually demanding conditions.[52] Construction workers are under continual and intense job pressure, which can lead to fatigue. Work fatigue frequently results in unpleasant feelings such as despair, discouragement, and low job satisfaction.[53] Emotional tension can cause

construction workers to lose focus and disregard proper practice.[54] In this study, the amount of stress has a substantial link with work fatigue in construction workers. Workplace stress has long been associated with work fatigue. According to the stress challenge-barrier model (challenge-hindrance stress model), participation in a stress challenge, such as job obligations, frequently results in beneficial organizational outcomes. While the stress barrier, specifically role overload, hurts organizational outcomes.[55] Long-term role overload causes employees to devote more time and energy to work while saving less time and energy to home life, leading to family disputes, impaired rest quality, and worse work fatigue.[34] Employees who are fatigue have reduced job satisfaction, psychological health, physical health, and organizational commitment, as well as increased turnover intentions and trouble relaxing after work.[56] Job stress directly influences fatigue, and all manifestations of anger indirectly affect the link between job stress and fatigue.[57]

IV. CONCLUSION

The bivariate analysis test findings show that BMI and stress levels have a strong link with work fatigue in construction workers. Labor fatigue is unrelated to age, education, work experience, or nutritional health. Work fatigue is impacted by various elements and situations, including sleep time, work shifts, the time spent working in a day, the physical work environment (noise, illumination, and vibration), and interpersonal connections between employees and others. Future research can look into the abovementioned components, making the results of the elements that cause work fatigue more complicated. Project organizers must use appropriate stress management and coping strategies for workers to prevent job fatigue and preserve workers' nutritional condition by supplying meals based on their caloric demands. Increasing the number of study participants is strongly advised because the results will be significantly more varied and significant.

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