

Work Fatigue, Body Mass Index, Individual Characteristics, and Their Relationships to Work Stress Among Elementary School Teachers in Semarang, Central Java, Indonesia

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ABSTRACT

Background: Work-related stress is a psychological and physiological condition that occurs when individuals are unable to cope with pressures arising from their job demands. Teachers are particularly vulnerable to stress due to multiple factors such as workload, curriculum demands, employment status, interpersonal relationships, and individual characteristics. Previous surveys in Central Java have reported that approximately 70% of teachers experience work-related stress, highlighting the urgency of this issue. This study aims to analyze the relationship between work fatigue, body mass index (BMI), gender, and age with work stress in elementary school teachers.

Subjects and Method: This study used a cross-sectional design conducted in public elementary schools in Tembalang and Banyumanik Districts, Semarang, Central Java, Indonesia, in late 2025. The study population was elementary school teachers in that area, with a sample of 201 teachers taken using a purposive sampling technique. The dependent variable was work stress (measured with the GHQ-12 questionnaire). Independent variables included job fatigue (measured with the “Kuesioner Alat Ukur Perasaan Kelelahan Kerja/KAUPK2” or Work Fatigue Assessment Questionnaire in Indonesian language), BMI, gender, and age.

Results: A total of 58.2% of teachers experienced high work stress. Bivariate test results showed no statistically significant relationship between job fatigue (OR=1.12; 95% CI= 0.560 to 2.321; p=0.185), BMI (OR=0.98; 95% CI=0.801 to 4.110; p=0.410), gender (OR=0.97; 95% CI= 0.981 to 3.105; p=0.249), and age (OR=1.01; 95% CI=0.331 to 4.102; p=0.843) with work stress.

Conclusion: The studied factors such as job fatigue, BMI, gender, and age were not proven to be significantly associated with work stress in this sample. A possible policy implication is the need to focus on creating a healthy organizational work environment rather than on individual teacher characteristics.

Keywords: work stress, work fatigue, body mass index

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BACKGROUND

Education is one of the crucial components in human life and in achieving a nation's development. Aligned with the vision and mission of the National Education System stated in Indonesian Law No. 20 of 2003 concerning the National Education System, the education system is intended as a social institution to develop all Indonesian citizens into quality human resources capable of facing the challenges of an ever-changing era (Mustadi, 2020). In Indonesia, education begins at the elementary school level. Elementary education is the initial step for students to undergo multifunctional development, encompassing physical, academic, personal-social, and career development. The school environment must be able to maximize student development to produce learners with good character and intelligent academic abilities (Salong et al., 2023).

Based on Bandura's theory, students begin to learn things (including hard and soft skills) by following models or examples around them. At the initial education level, namely elementary school, student learning habits can be instilled by providing exemplary and characterful teacher role models (Bandura, 1997; Salong et al., 2023). According to the quality of education stated by UNICEF, five elements are covered to meet educational quality, one of which is the readiness of trained educators. Teachers are not only tasked with teaching, which prioritizes the transfer of knowledge to children, but teachers should also be able to educate students in developing personality, morals, and mental attitudes. Furthermore, teachers should be able to condition the classroom atmosphere to create a conducive and meaningful climate for the student learning process (Mustadi, 2020). Teachers are required to perform their jobs by producing and providing the best possible service to school users such as students, parents, and

the surrounding community (Hendrawan et al., 2018; Winowod, 2022).

Generally, elementary school teachers have more monotonous teaching activities compared to junior and senior high school teachers. This is because elementary school teachers serve as homeroom teachers responsible for teaching students in one class, meaning they face the same students every day. This leads to high expectations and reliance from students' parents on the homeroom teacher (Hendrawan et al., 2018). Teaching is a profession dominated by mental workload, as the teacher's responsibilities and tasks involve psychic and non-physical work. This profession is among those with a high workload. In a week, a teacher's normal workload consists of 37.5 effective working hours and 2.5 hours of rest. This includes planning, implementing, assessing student learning outcomes, teaching and coaching students, and performing additional duties. The multitude of responsibilities borne by teachers has the potential to cause excessive mental workload. Work stress can arise, among other reasons, due to excessive mental workload (Salsabilla et al., 2018). An excessively high workload can lead to overstress for mental work and possible overuse of energy for physical work. Conversely, if the given workload is too low, it can lead to understress for mental work and boredom for physical work (Achmar et al., 2018). If the work stress experienced by teachers is not addressed properly, it can impact their physical health, psychological condition, and behavior (Pertiwi and Wardani, 2018).

In responding to all demands placed on homeroom teachers from within and outside the individual, efforts are needed to regulate the intensity of the optimal load between these two extreme limits of workload. Certainly, the efforts made will differ from one individual to another

(Achmar et al., 2018). An individual will undertake actions called coping to resolve stressful situations within themselves. Stress coping strategies can be effective or ineffective. Effective coping allows a person to adapt to new habits to improve old habits in facing certain situations. In contrast, ineffective coping results in maladaptive behavior that deviates from the intended solution (Lio et al., 2018). One factor causing differences in how individuals handle pressure is their experience or length of service. This is considering that knowledge and experience can contribute to classroom management skills, as adequate education supported by long work experience allows teachers to better understand various aspects of tasks directly related to improving student learning achievement (Achmar et al., 2018; Merida-Lopez, 2017).

Mental health is an important aspect that influences the quality of life and productivity of individuals, including in the workplace. Elementary school teachers have a significant responsibility in guiding and educating young generations but often face substantial challenges that can potentially affect their mental health. Previous studies indicate that high-pressure jobs, such as teaching, tend to have high-stress levels due to increasing work demands (Pertiwi, 2018). In this context, factors like work intensity, workload, fatigue, and student pressure are key issues requiring attention.

The factor of work fatigue is equally important. Work fatigue among teachers is caused by high job demands, non-ideal physical and mental workloads, and sustained stress, which can lead to physical symptoms like aches and dizziness, decreased concentration, and mental health issues. Conversely, stagnation in career paths can diminish work morale and lead to psychological problems like depression or burnout. Additionally, the work environment, influenced

by school management and organizational climate, can impact the overall mental well-being of teachers. A positive organizational climate and supportive management have been proven to contribute to improved performance and emotional well-being of teachers (Achmar et al., 2018).

The social environment and family background also play a crucial role in mental health. Social support from colleagues, family, and the community significantly impacts a teacher's ability to manage work stress. Conversely, conflicts in social relationships or family pressures can worsen their mental condition. Research shows that work-life balance is essential for maintaining emotional stability and individual mental health (Winowod et al., 2018).

In the context of occupational safety and health, efforts to improve public health, particularly teacher mental health, are crucial. Teachers with good mental health will be better able to carry out their duties of educating the younger generation optimally, ultimately positively impacting the quality of national education. Therefore, understanding the factors influencing the mental health of elementary school teachers is crucial to designing appropriate interventions and supporting their sustainable well-being.

SUBJECTS AND METHOD

1. Study Design

This was a cross-sectional study conducted in public elementary schools located in Tembalang and Banyumanik Districts, Semarang, Central Java, Indonesia, from July to September 2025.

2. Population and Sample

The target population of this study was all elementary school teachers in Semarang City, while the source population was elementary school teachers working in Tembalang and Banyumanik Districts. The

sampling technique used was purposive sampling, resulting in a sample size of 201 teachers.

3. Study Variables

The independent variables in this study included job fatigue, Body Mass Index (BMI), and individual characteristics such as gender and age. The dependent variable was work stress.

4. Operational Definition of Variables

Work stress is a state of physical and psychological tension experienced by employees due to an imbalance between job demands and individual abilities. It affects emotions, thought processes, and behavior, potentially reducing productivity, causing fatigue, and triggering feelings of anxiety or anger.

Job fatigue is a decrease in efficiency, performance, and physical/mental endurance due to prolonged work activities or excessive workloads, characterized by symptoms such as drowsiness, muscle weakness, dizziness, and low motivation. This is a subjective body response but impacts decreased productivity and an increased risk of workplace accidents.

Body Mass Index (BMI) is a Mathematical calculation method that compares body weight (kg) to the square of height (m²) to determine whether a person is at an ideal weight, underweight, overweight, or obese. It is a quick health screening tool to identify the risk of weight-related diseases.

Age is the length of time a person or creature has lived or existed since birth until a certain date. Generally, age is calculated in years based on the calendar system, which indicates a person's level of physical, mental, and experiential maturity. Age is often used as a benchmark for determining rights, obligations, and developmental stages.

Gender or Sex is an innate biological characteristic (chromosomes, reproductive organs, hormones) that is generally divided

into male and female. Gender is a socio-cultural construct of roles, behaviors, and identities (masculine/feminine) that is shaped by society and is subject to change.

5. Study Instruments

Work stress was measured using the General Health Questionnaire-12 (GHQ-12). The GHQ-12 is a valid and reliable screening instrument for measuring work stress and psychological distress. This instrument consists of 12 questions focusing on mental health, such as concentration, stress perception, happiness, and self-confidence. The GHQ-12 is effective in detecting workplace stress levels. Work stress is categorized into mild, moderate, and high stress.

Work fatigue was measured using the Work Fatigue Feelings Measurement Questionnaire, a subjective method developed by Setyawati to measure work fatigue in Indonesia. The three main aspects of this questionnaire include 17 questions: 7 questions about activity impairment, 3 questions about motivation impairment, and 7 questions about physical symptoms. The questions focus on complaints such as difficulty thinking, tiredness when speaking, nervousness, and lack of concentration. Work fatigue is categorized into three categories: low, moderate, and high.

Body Mass Index (BMI) is measured by comparing body weight (kg) to the square of height (m²). BMI categories (Asian/ Indonesian Standard): <17.0= severe underweight; 17.0 - 18.4= Underweight; 18.5 - 25.0= Normal weight; 25.1 - 27.0= Overweight; >27.0= Obese.

6. Data analysis

Data analysis was conducted to examine the relationship between job fatigue, body mass index (BMI), individual characteristics (age and gender), and work stress among elementary school teachers in Semarang, Central Java, Indonesia. Analysis was performed in several stages. Univariate

analysis was performed to describe the frequency distribution and percentage of each variable, including work fatigue, BMI, gender, age, and work stress level. Bivariate analysis was performed to test the relationship between each independent variable (job fatigue, BMI, gender, age) and the dependent variable (work stress).

The chi-square test was used for categorical data. Fisher's Exact Test was applied when the number of cells in the cross-tabulation was less than 5. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using statistical software (SPSS), with the significance level set at $\alpha = 0.05$.

7. Research Ethics

This research was conducted after going through an ethical test from the Ethics Committee of the Faculty of Public Health

and receiving an ethical clearance letter with the number: 329/EA/KEPK-FKM/2025, on September 22, 2025.

RESULTS

1. Sample Characteristics

This study involved 201 elementary school teachers in Semarang. The sample characteristics are presented in Table 1. The majority of respondents were female (69.2%) and had a body mass index (BMI) classified as overweight (51.7%). Regarding occupational fatigue, most teachers reported experiencing mild fatigue (83.1%). Notably, more than half of the respondents (58.2%) reported high levels of work-related stress, indicating that work stress remains a significant concern among elementary school teachers.

Table 1. Sample Characteristics (N=201)

Characteristics	Category	Frequency	Percentage (%)
Work Stress	Low	1	0.5
	Moderate	167	83.1
	High	33	16.4
Body Mass Index (BMI)	Underweight	10	5.0
	Normal	87	43.3
	Overweight	104	51.7
Gender	Male	62	30.8
	Female	139	69.2
Age	26-35 years	79	39.3
	36-45 years	76	37.8
	46-55 years	29	14.4
	56-65 years	17	8.5
Job Stress	Low Stress	50	24.9
	Moderate Stress	34	16.9
	High Stress	117	58.2

2. Bivariate Analysis

Bivariate analysis was conducted to examine the association between each independent variable (job fatigue, BMI, gender, and age) and the dependent variable (work stress). The results showed that none of the independent variables were significantly associated with work stress (p-value > 0.05). As presented in Table 2, job fatigue was not

significantly associated with work stress, although teachers with higher levels of fatigue were 1.12 times more likely to experience work stress compared to those with lower fatigue levels (OR = 1.12; 95% CI: 0.56–2.32; p = 0.185). BMI was also not significantly associated with work stress, with an odds ratio of 0.98 (95% CI: 0.80–4.11; p = 0.410). Similarly, gender showed

no significant association with work stress, as female teachers had a comparable likelihood of experiencing work stress compared to male teachers (OR = 0.97; 95% CI: 0.98–3.10; $p = 0.249$). Age was likewise not significantly associated with work stress, with older teachers being 1.01 times more likely to experience work stress than younger teachers (OR = 1.01; 95% CI: 0.33–4.10; $p = 0.843$).

Although these associations were not statistically significant, a descriptive trend was observed in which the proportion of teachers experiencing high work stress increased alongside higher levels of job fatigue, ranging from 0% among teachers with low fatigue to 56.9% among those with moderate fatigue and 66.7% among those with high fatigue. However, because the statistical tests did not demonstrate significance, these findings should be interpreted cautiously and cannot be generalized to the broader population. Further studies with larger sample sizes are needed to clarify these relationships.

DISCUSSION

This study aimed to analyze the relationship between job fatigue, BMI, individual characteristics (gender and age), and work stress among elementary school teachers. The results of the bivariate analysis showed no statistically significant association between any of the independent variables and work stress ($p > 0.05$). These findings are not entirely consistent with existing theories and previous studies, thus requiring further critical interpretation.

The non-significant association between job fatigue and work stress is an important finding. This result contradicts the cognitive transactional theory proposed by Lazarus and Folkman (1984), which states that stress arises from an imbalance

between environmental demands and an individual's coping capacity. Previous studies have consistently demonstrated a positive relationship between fatigue and stress. A meta-analysis conducted by Salvagioni et al. (2017), involving 92 studies, concluded that work fatigue is a strong predictor of mental health problems, including stress, across various professions. One possible explanation for the inconsistency observed in this study is the presence of unmeasured moderating factors. Teachers in Semarang may possess effective coping mechanisms or receive strong social support from family members, colleagues, and school institutions, which may buffer the negative impact of fatigue on work stress (Khan et al., 2020). Furthermore, the *KAUPK2* instrument used in this study may not fully capture the multidimensional aspects of burnout, such as emotional exhaustion and depersonalization, as comprehensively as the Maslach Burnout Inventory (MBI), thereby reducing the sensitivity of the measurements.

The finding that BMI was not significantly associated with work stress also provides additional insight. Previous study by Khan et al. (2020) suggested that obesity may increase physiological stress responses through chronic inflammatory mechanisms. However, in the context of elementary school teachers, psychosocial stressors related to occupational demands, such as curriculum pressure, student discipline, and administrative workload, may be more dominant and immediate than biological or metabolic stressors associated with BMI (Jackson et al., 2022). Consequently, variations in work stress levels among teachers may be more strongly influenced by workplace and organizational factors than by individual biological characteristics.

Table 2. Determinants of Work Fatigue, BMI, Individual Characteristics, and Work Stress among Elementary School Teachers

Independent Variables	Work Stress						Total		OR	95% CI		P
	Low		Moderate		High		N	%		Lower Limit	Upper Limit	
	N	%	N	%	N	%						
Work Fatigue												
Low	0	0.0	1	100.0	0	0.0	1	100.0	1.12	0.56	2.32	0.185
Moderate	45	26.9	27	16.2	95	56.9	167	100.0				
High	5	15.2	6	18.2	22	66.7	33	100.0				
BMI												
Underweight	3	30.0	2	20.0	5	50.0	10	100.0	0.98	0.80	4.11	0.410
Normal	16	18.4	16	18.4	55	63.2	87	100.0				
Overweight	31	29.8	16	15.4	57	54.8	104	100.0				
Gender												
Male	12	19.4	14	22.6	36	58.1	62	100.0	0.97	0.98	3.10	0.249
Female	38	27.3	20	14.4	81	58.3	139	100.0				
Age												
26-35 years	16	20.3	16	20.3	47	59.5	79	100.0	1.01	0.33	4.10	0.843
36-45 years	21	27.6	13	17.1	42	55.3	76	100.0				
46-55 years	8	27.6	3	10.3	18	62.1	29	100.0				
56-65 years	5	29.4	2	11.8	10	58.8	17	100.0				

Regarding individual characteristics, the absence of significant associations between gender, age, and work stress is consistent with several recent studies suggesting that stressors in high-pressure work environments tend to affect individuals similarly regardless of demographic background (Sari et al., 2025). Nevertheless, other studies, including research conducted by García-Carmona et al. (2021), reported that female and younger teachers experienced higher levels of work stress. These inconsistencies indicate that the influence of demographic characteristics on work stress is highly dependent on local sociocultural and organizational contexts. In Indonesia, where collectivist values and the culture of mutual cooperation (gotong royong) remain strong, social support may be distributed more evenly across individuals, thereby reducing disparities in stress levels based on gender or age.

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AUTHOR CONTRIBUTIONS

Ida Wahyuni is the main researcher in this study, determining the topic, conducting research, collecting data, analyzing data, and writing the manuscript. Yuliani develops conceptual framework topics, guides data analysis, and interprets the results of data analysis. Khairun Nisa and Rosyida help to collect data, analyze data, and write the manuscript.

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CONFLICT OF INTEREST

There is no potential conflict of interest in this study.

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