

ORIGINAL

## The Influence of Individual Characteristics, Workload and Work Climate on Performance Through Job Stress in Workers at Pt. Maruki International Indonesia

### La influencia de las características individuales, la carga de trabajo y el clima laboral en el rendimiento a través del estrés laboral en los trabajadores de Pt. Maruki Internacional Indonesia

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#### ABSTRACT

**Introduction:** worker performance is influenced by individual characteristics, workload and work climate, with work stress often being a factor that reduces performance.

**Method:** this cross-sectional study of 148 production workers at PT Maruki International Indonesia (May–July 2025) examined the effects of age, gender, physical and mental workload, and work climate on performance, with work stress as a mediator. Data collected using performance questionnaires, NASA-TLX, heat stress monitors, pulse oximeters, and salivary  $\alpha$ -amylase tests were analyzed through SPSS (univariate-bivariate) and AMOS path analysis to assess direct and mediating effects.

**Results:** the results at the 95 % confidence level or CI=0,05 show that age has a significant effect ( $p=0,320>0,05$ ), but a significant positive effect on performance ( $p=0,000 <0,05$ ). Gender has a significant effect on job stress ( $p=0,038 <0,05$ ) and performance ( $p=0,004 >0,05$ ). Physical workload has no significant effect on work stress ( $p=0,810>0,05$ ) and performance ( $p=0,330>0,05$ ). Mental workload has a significant effect on work stress ( $p=0,000 <0,05$ ) but not significant on performance ( $p=0,258 >0,05$ ). Work climate has no significant effect on work stress ( $p=0,636>0,05$ ) and performance ( $p=0,613>0,05$ ). Job stress itself has a significant positive effect on performance ( $p=0,000 <0,05$ ). Job stress mediates the relationship of age to performance (indirect effect=0,027), physical workload to performance (indirect effect=0,009), and work climate to performance (indirect effect=-0,018).

**Conclusions:** worker performance is directly influenced by age, gender and job stress and indirectly by age, physical workload and work climate through job stress.

**Keywords:** Individual Characteristics; Workload; Work Climate; Work Stress; Performance.

#### RESUMEN

**Introducción:** el rendimiento laboral se ve influenciado por las características individuales, la carga de trabajo y el clima laboral, siendo el estrés laboral un factor que a menudo lo reduce.

**Método:** Este estudio transversal de 148 trabajadores de producción en PT Maruki International Indonesia (mayo-julio de 2025) examinó los efectos de la edad, el género, la carga de trabajo física y mental, y el clima laboral en el rendimiento, utilizando el estrés laboral como mediador. Los datos recopilados mediante cuestionarios de rendimiento, NASA-TLX, monitores de estrés térmico, oxímetros de pulso y pruebas de  $\alpha$ -amilasa salival se analizaron mediante análisis de trayectoria SPSS (univariante-bivariante) y AMOS para

evaluar los efectos directos y mediadores.

**Resultados:** los resultados con un nivel de confianza del 95 % o IC=0,05 muestran que la edad tiene un efecto significativo ( $p = 0,320 > 0,05$ ), pero un efecto positivo significativo en el rendimiento ( $p=0,000 < 0,05$ ). El género tiene un efecto significativo sobre el estrés laboral ( $p=0,038 < 0,05$ ) y el rendimiento ( $p=0,004 > 0,05$ ). La carga física no tiene un efecto significativo sobre el estrés laboral ( $p=0,810 > 0,05$ ) ni sobre el rendimiento ( $p=0,330 > 0,05$ ). La carga mental tiene un efecto significativo sobre el estrés laboral ( $p=0,000 < 0,05$ ), pero no sobre el rendimiento ( $p=0,258 > 0,05$ ). El clima laboral no tiene un efecto significativo sobre el estrés laboral ( $p=0,636 > 0,05$ ) ni sobre el rendimiento ( $p=0,613 > 0,05$ ). El estrés laboral, por sí mismo, tiene un efecto positivo significativo sobre el rendimiento ( $p=0,000 < 0,05$ ). El estrés laboral media la relación entre la edad y el rendimiento (efecto indirecto = 0,027), la carga física y el rendimiento (efecto indirecto = 0,009) y el clima laboral y el rendimiento (efecto indirecto = -0,018).

**Conclusiones:** el rendimiento laboral se ve directamente influenciado por la edad, el género y el estrés laboral, e indirectamente por la edad, la carga física de trabajo y el clima laboral a través del estrés laboral.

**Palabras clave:** Características Individuales; Carga de Trabajo; Clima Laboral; Estrés Laboral; Rendimiento.

## INTRODUCTION

Companies with optimal performance are able to manage human resources effectively to achieve goals, both at the individual and organizational levels. Low HR performance can also be caused by job stress. Stress is a condition of pressure that is influenced by a person's emotions and thought processes. If stress levels are too high, this can interfere with the ability of HR to adapt to their environment, which ultimately has an impact on reducing performance.<sup>(1)</sup> Job stress is a condition that arises from the interaction between individuals and their jobs, which is caused by a mismatch of characteristics and unclear changes in the company. Every worker has a certain role in the organization, where they are given duties and responsibilities that must be carried out according to company rules and expectations. When workers experience job stress, this can be detrimental to the organization because their performance decreases. However, not all workers are able to carry out their roles without facing obstacles or problems.<sup>(2)</sup>

The American Psychological Association (APA) survey results reported that 77 % of Americans experience work-related stress. In Indonesia, work stress is a serious problem as evidenced by the results of the Basic Health Research (Risikesdas) by the Ministry of Health in 2023 showing that the prevalence of the Indonesian population aged >15 years who experienced mental emotional disorders or stress 630 827 people (2,0 %) and the prevalence in private employees around 71 965 people (1,2 %) experienced mental emotional disorders or stress. The province with the highest prevalence of mental emotional disorders or stress is West Java 4,4 % and the lowest prevalence is Bangka Belitung Islands 0,5 % while for the prevalence of South Sulawesi is 2,7 % or around 21 208 people who experience mental emotional disorders or stress.<sup>(3,4)</sup>

Stress is one of the factors that affect performance. Stress is a normal thing that can be felt by humans. Job stress is defined as a physically detrimental emotional disturbance that occurs when work does not match the skills, resources, and needs of workers. A person can feel physical stress caused by monotonous activities, not getting enough sleep, poor diet or the effects of an illness. Research conducted by Ilham, 2022 that work stress has a positive and significant effect on employee performance. This means that the greater the work stress felt by employees, the greater the level of employee performance.<sup>(5,6,7)</sup>

Individual characteristics that affect performance include: age, gender, education, length of service, job placement and work environment (top colleagues, superiors, organization, awards and rewards) Research conducted by Indrianna, 2022 that employee age affects employee performance. Age  $\leq 30$  years has a relatively good level of performance and age  $\geq 30$  years has a decreased performance. The results of Wilda's research, 2022 show that gender has a significant effect on performance. These results indicate that employees who are male and female have the same work behavior in completing their duties, but men and women have different abilities in completing work that is considered heavy.<sup>(8,9,10)</sup>

Work climate is a combination of work temperature, air humidity, air movement speed, and radiation temperature in a workplace. An uncomfortable work climate, not in accordance with the specified requirements can reduce work capacity which results in decreased work efficiency and productivity. The air temperature that is considered favorable for Indonesians is around 24°C-26°C and the difference in temperature inside and outside should not be more than 5°C. The wind speed limit is roughly 0,25 to 0,5 m/s.<sup>(11)</sup>

In addition to the work climate being a factor that affects performance, workload is one of the factors that affect worker performance. Workload refers to a set of tasks or activities that must be completed by an organizational unit within a certain period of time. The number of tasks and responsibilities given to employees

that are too many can cause work results to be less than optimal, because the time available to complete these tasks is limited. If this condition continues to recur, it can affect the performance of the employees themselves. <sup>(12)</sup> Research conducted at PT Maruki Internasional Indonesia Makassar found that workers in the production department are vulnerable to work stress due to high workload and unfavorable environmental conditions. A study conducted by Qalbi, 2013 revealed that of the 21 workers surveyed, 57,1 % of them experienced work stress, while 42,9 % did not experience stress.<sup>(13)</sup>

## **METHOD**

### **Study Design**

This research employed a quantitative cross-sectional design to capture conditions at a single point in time. The study was conducted at PT Maruki International Indonesia, Makassar, over a three-month period from May to July 2025, focusing on production unit activities and worker conditions during regular operational hours.

### **Population and Sample**

The study population consisted of all production workers employed at the company, and a total of 148 workers were included using total sampling to enhance representativeness. Inclusion criteria were active employment for at least six months, age 18-55 years, and willingness to participate. Exclusion criteria included illness or leave during data collection, while exit criteria were withdrawal from the study or incomplete physiological or questionnaire data.

### **Variables Analyzed**

The independent variables were age, gender, physical workload, mental workload, and work climate, selected because they are known determinants of occupational performance. The dependent variable was worker performance, while job stress was positioned as an intervening or mediating variable. Physical workload and job stress were highlighted as variables requiring physiological measurement due to their non-observable nature.

### **Instruments, Techniques, and Procedures**

Data collection used validated and widely recognized tools. The performance variable was measured through a standardized performance questionnaire, and mental workload was assessed using the NASA-TLX instrument. Work climate was quantified using a heat stress monitor (WBGT index), physical workload was measured with a pulse oximeter assessing heart rate changes, and job stress was examined through salivary  $\alpha$ -amylase levels using a cocrrometer. All instruments have established validity and reliability in occupational health research, and trained field researchers followed standardized measurement procedures.

### **Data Collection Process**

The process began with an initial briefing and informed consent, followed by the distribution and completion of questionnaires. Physiological measurements were conducted individually in controlled conditions to reduce bias: WBGT readings were taken at multiple points in the production area, pulse oximetry was recorded before and after workload activities, and saliva samples were collected using sterile kits before laboratory analysis with the cocrrometer.

### **Data Analysis Process**

Data were processed using SPSS for univariate analysis to describe variable distributions, and bivariate analysis using simple correlation and regression tests to identify significant relationships. Furthermore, AMOS-based path analysis was employed to examine the multivariate structure, specifically assessing direct effects among variables and the mediating role of job stress in the relationship between workload, work climate, and performance.

### **Ethical Considerations**

The study adhered to research ethics principles, emphasizing confidentiality, voluntary participation, and safe biological sample handling. Ethical approval was obtained from the Faculty of Public Health, Hasanuddin University, under Approval No. 873/UN4.14.1/TP.01.02/2025, and all respondents provided written informed consent prior to participation.

## **RESULT**

The characteristics of respondents, including length of service and latest education, can be seen in the following table.

**Table 1.** Frequency Distribution of Respondents' Characteristics Based on Period of Work and Last Education of Workers

Respondent Characteristics	Frequency (n)	Percentage (%)
Period of Work		
> 5 years	144	97,3
≤ 5 Years	4	2,7
Total	148	100
Last Education		
Elementary School	13	8,8
Junior High School	26	17,6
High School	100	67,6
D3	5	3,4
S1	4	2,7
Total	148	100

Table 1 shows that out of 148 respondents, the distribution of working period shows that the majority of respondents have a working period of > 5 years as many as 144 (97,3 %), while only 4 (2,7 %) workers have a working period of ≤ 5 years. For the latest education, most respondents are high school graduates as many as 100 (67,6 %) workers. Then followed by junior high school graduates as many as 26 (17,6 %) workers, elementary school as many as 13 (8,8 %) workers, D3 as many as 5 (3,4 %) workers and the least is S1 graduates as many as 4 (2,7 %) workers.

**Table 2.** Bivariate Analysis of the Effect of Age, Gender, Physical Workload, Mental Workload and Work Climate on Job Stress

Variable	Work Stress				Total		p-Value	
	Stress		Normal		N	%		
	N	%	N	%	N	%		
Age	> 35 years	22	23,3	93	91,7	115	100	0,520
	≤ 35 Years	8	6,7	25	26,3	33	100	
	Total					148		
Gender	Male	16	20,9	87	82,1	103	100	0,030
	Female	14	9,1	31	35,9	45	100	
	Total					148		
Physical Workload	Heavy	14	13,2	51	51,8	65	100	0,734
	Mild	16	16,8	67	66,2	83	100	
	Total					148		
Mental Workload	Heavy	23	11,6	34	45,4	57	100	0,000
	Medium	4	9,9	45	39,1	49	100	
	Lightweight	3	8,5	39	33,5	42	100	
Work Climate	Total					148		0,960
	Not Qualified	8	8,1	32	31,9	40	100	
	Qualified	22	21,9	86	86,1	108	100	
Total						148		

Table 2 bivariate analysis shows that the age variable has  $p = 0,520$ , so there is no significant influence with work stress. The gender variable obtained  $p=0,030$ , which means there is a significant influence with work stress. The physical workload variable has  $p=0,734$ , indicating no significant influence on work stress. The mental workload variable has  $p=0,000$ , which means there is a significant influence with work stress. The work climate variable obtained  $p=0,960$ , so there was no significant influence with work stress.

**Table 3.** Bivariate Analysis of the Effect of Age, Gender, Physical Workload, Mental Workload, Work Climate and Job Stress on Performance

Variable		Performance				Total	p-Value		
		Less		Good					
		N	%	N	%				
Age	> 35 years	15	19,4	100	95,6	115	100	0,020	
	≤ 35 Years	10	5,6	23	27,4	33	100		
	Total					148			
Gender	Male	13	17,4	90	85,6	103	100	0,036	
	Female	12	7,6	33	37,4	45	100		
	Total					148			
Physical Workload	Heavy	13	11	52	54	65	100	0,372	
	Mild	12	14	71	69	83	100		
	Total					148			
Mental Workload	Heavy	15	9,6	42	47,4	57	100	0,018	
	Medium	8	8,3	41	40,7	49	100		
	Lightweight	2	7,1	40	34,9	42	100		
	Total					148			
Work Climate	Not Qualified	7	6,8	33	33,2	40	100	0,904	
	Qualified	18	18,2	90	89,8	108	100		
	Total					148			
Occupational Stress	Stress	15	5,1	15	24,9	30	100	0,000	
	Normal	10	19,9	108	98,1	118	100		
	Total					148			

Table 3 shows the bivariate results that the age variable has  $p = 0,020$ , which means there is a significant influence between age and performance. The gender variable has  $p = 0,036$ , so there is a significant influence between gender and performance. The physical load variable obtained  $p=0,372$ , so there was no significant influence on performance. The mental workload variable shows  $p = 0,018$ , which means there is a significant influence between mental workload and performance. The work climate variable has  $p=0,004$ , so there is a significant influence on performance and the work stress variable has  $p=0,000$ , meaning there is a significant influence between work stress and performance.

**Table 4.** Normality Test Results

One-Sample Kolmogorov-Smirnov Test		
Unstandardized Residual		
N		148
Normal Parameters <sup>a,b</sup>	Mean	0,0000000
	Std. Deviation	3,61188735
Most Extreme Differences		
Absolute		0,071
Positive		0,046
Negative		-0,071
Test Statistic		0,071
Asymp. Sig. (2-tailed)		0,066 <sup>c</sup>

**Note:** a. Test distribution is Normal.

Table 4 shows the output of the *one-sample kolmogorov-smirnov test*, the Asymp. Sig. (2-tailed) of 0,066. This value is greater than the specified significance level, which is 0,05, so it can be concluded that the residual data is normally distributed. Thus, the normality assumption in regression has been met and can be used for further testing.

**Table 5.** Multivariate Analysis of the Direct Effect of Independent Variables on Dependent and Intervening Variables

Research Variable	Estimate	S.E	C.R	p-Value
Age→ Job Stress	0,083	0,083	0,995	0,320
Gender→ Job Stress	0,150	0,072	2,073	0,038
Physical Workload→ Job Stress	0,021	0,087	0,241	0,810
Mental Workload→ Job Stress	0,168	0,039	4,291	0,000
Work Climate→ Job Stress	-0,047	0,099	-0,474	0,636
Age→ Performance	0,248	0,070	3,541	0,000
Gender→ Performance	0,176	0,061	2,867	0,004
Physical Workload→ Performance	-0,072	0,073	-0,974	0,330
Mental Workload→ Performance	0,040	0,035	1,132	0,258
Work Climate→ Performance	0,042	0,083	-0,506	0,613
Job Stress→ Performance	0,331	0,069	4,788	0,000

Table 5 shows the results of direct effect analysis that gender has a significant effect on work stress  $p=0,038$  and mental workload  $p=0,000$  has a significant effect on work stress, while age, physical workload, and work climate have no significant effect. Furthermore, age  $p=0,000$ , gender  $p=0,004$  and work stress  $p=0,000$  proved to have a significant effect on performance. In contrast, physical workload, mental workload and work climate have no significant effect on performance.

**Table 6.** Multivariate Analysis of Indirect Effects of Independent Variables on Dependent Variables and Intervening Variables

Path	Indirect Effect	Conclusion
Age→ Job Stress→ Performance	0,027	Significant
Gender→ Job Stress→ Performance	0,063	Not Significant
Physical Workload→ Job Stress→ Performance	0,009	Significant
Mental Workload→ Job Stress→ Performance	0,120	Not Significant
Work Climate→ Job Stress→ Performance	-0,018	Significant

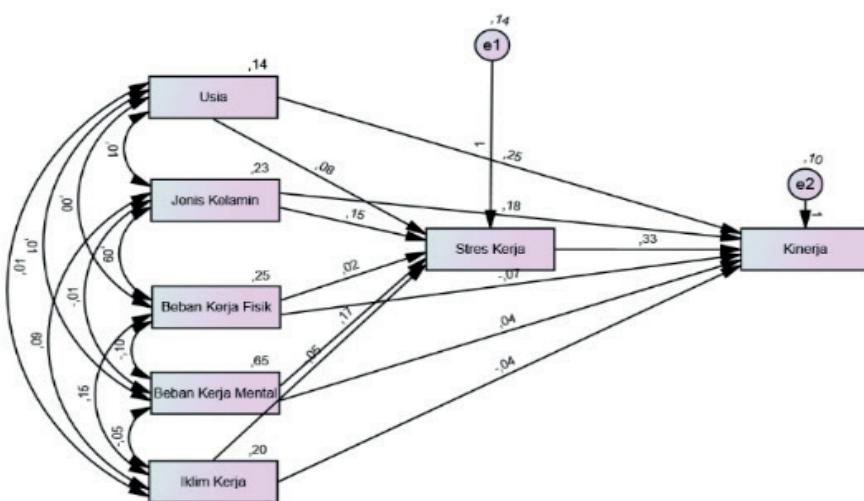
**Figure 1.** Final Path Model

Table 6 shows the results of the indirect effect analysis that age (indirect effect =0,027), physical workload (indirect effect=0,009) and work climate (indirect effect=-0,018) have an indirect effect on performance through job stress. Meanwhile, gender (indirect effect=0,063) and mental workload (indirect effect=0,120) have no indirect effect on performance through job stress. Based on the results of path analysis, the results of regression values, direct and indirect effects are obtained which then found the results of the scheme of the influence of individual characteristics, workload and work climate on performance with job stress as an intervening variable, as follows at figure 1.

## DISCUSSION

The results of this study indicate that age has an indirect effect on performance through job stress, so job stress acts as a mediating variable. This study also proves that age has a direct and significant effect on performance. This finding supports the human capital theory, which emphasizes that with age, individuals accumulate knowledge, skills, and work experience so as to increase productivity. In other words, the more mature a worker is, the higher the contribution made to the organization.<sup>(14)</sup> In line with Indrianna's research, 2022 that younger employees ( $\leq 30$  years) tend to have better performance than older employees ( $\geq 30$  years). This is associated with physical capacity, energy, and work speed that are more optimal at a young age. Along with age, employee performance can decline because age is not a guarantee of the quality of one's work.<sup>(9)</sup> On the other hand, older age cannot be completely ignored, because the discipline, responsibility, and work experience that have been accumulated over the years make them still have an important contribution. In other words, older employees may not always show as high physical performance as younger employees, but their experience and stability are a plus for the company. This confirms that age does affect performance, but is not the only determining factor as other aspects such as experience, discipline and work adaptation are also very instrumental.<sup>(15)</sup>

The results of this study reveal that the indirect effect between gender on performance through job stress is not statistically significant. Thus, job stress does not mediate the relationship between gender and performance in this model. This finding can be understood within the framework of the Transactional Model of Stress and Coping (Lazarus & Folkman), which emphasizes that stress is influenced by the cognitive appraisal process (primary and secondary appraisal) and individual coping strategies, rather than simply demographic dimensions. In other words, while there may be differences in stress levels between men and women, the effectiveness of coping strategies can equalize their impact on performance.<sup>(16)</sup>

Previous research consistent with these results includes a study by Padkapayeva, 2018 which found that the relationship between job exposures such as supervisor support and job insecurity with job stress differed between genders that the effects of stress on men and women are not uniform confirming that the gender stress-performance relationship is complex and does not involve simple mediation.<sup>(17)</sup>

The results of this study indicate that physical workload has an indirect effect on performance through job stress. This means that job stress acts as a mediating variable that bridges the relationship between physical workload and performance. On the other hand, the results also found that physical workload has no direct effect on job stress nor on employee performance. This shows that even though physical workload increases, employees do not automatically feel higher stress or experience a decrease in performance. In line with the findings from Asetya's research, 2023 which found that workload has a direct negative effect on performance and also increases job stress, but job stress clearly mediates the effect of workload on performance. Despite the presence of job stress, other factors may change the dynamics of the relationship, and mediation does not always apply in all contexts.<sup>(18)</sup> Consistent with research by Ulfa, 2025 which shows that workload has a negative but insignificant effect on job stress. This indicates that an increase in workload does not necessarily trigger stress, even in some cases it tends to reduce it. However, since this relationship is not statistically significant, it can be concluded that workload is not the dominant factor causing stress. Another possibility is that employees view workload as a form of challenge that can increase motivation at work.<sup>(19)</sup>

The results showed that mental workload has no indirect effect on performance through job stress. In line with that, Achmad's research, 2022 shows that although workload has a significant effect on job stress, job stress does not have a significant effect on performance. This leads to the absence of a mediating effect, which means that work stress is not a connecting path between workload and performance. This difference in results indicates that the effect of work stress on performance is highly dependent on the work environment, the nature of work, individual characteristics, and the management strategies applied in managing workload.<sup>(20)</sup> Mental workload is the cognitive or psychological demands that employees must face in carrying out their work. In contrast to physical workload that emphasizes body strength, mental workload is related to the process of thinking, concentration, decision making, memory, problem solving, and emotional control.<sup>(21)</sup> This finding is different from the results of research by Iriansyah, 2024 which shows that workload has a significant effect on job stress, job stress has a significant effect on performance, and job stress significantly mediates the effect of workload on performance. Thus, when both physical and mental workload increases, the level of work stress tends to rise, and this increase in stress can affect employee performance.<sup>(22)</sup>

The results of this study indicate that the indirect effect of work climate on performance through job stress is -0,018 and proven significant. The negative value indicates the opposite direction of the relationship, that is, the better the work climate, the level of job stress tends to decrease, and the decrease in stress has an impact on improving performance. Thus, job stress acts as a negative mediator in the relationship between work climate and employee performance. In the context of the world of work, Stringer suggests that the factors that contribute to improving employee performance do not only come from individual abilities, but are also influenced by the work climate and work stress levels. Work climate is defined as the condition of the

work environment that is felt either directly or indirectly by workers, which ultimately affects their behavior and work results. A number of previous studies also support this result. Cheung, 2016 found that exposure to excessive heat (heat stress) reduces the physical and cognitive work capacity of workers, thus having a direct impact on performance. Another study by Walker, 2016 revealed that workers who are accustomed to facing hot working climate conditions tend to be able to adapt, so that the impact of decreased performance can be minimized. Meanwhile, Chan, 2016 explained that heat stress can reduce productivity, cause physiological and psychological discomfort, and increase the risk of work accidents. However, if heat conditions can be controlled through proper work environment management, the impact of stress can be suppressed so that worker performance remains optimal.<sup>(23,24,25)</sup>

### Implications

The findings of this study highlight the importance of demographic and individual factors—particularly age—in shaping employee performance within industrial settings. Since age directly and indirectly influences performance through job stress, companies should integrate age-responsive management strategies. Younger workers may demonstrate higher physical output, while older employees contribute through experience, discipline, and work stability. This implies that organizations should implement age-diverse task allocation, provide ergonomic adjustments for older workers, and ensure continuous upskilling programs that maximize the strengths of each age group. Another implication relates to workload management—both physical and mental—as well as the non-significant mediating role of job stress in some relationships. The fact that physical and mental workloads do not consistently influence performance through stress suggests that employees may interpret workload as a challenge rather than a strain when adequate coping resources, training, or motivation are present. Therefore, companies must not rely solely on reducing workload but rather focus on improving workers' coping capacity, strengthening supervisor support, and providing clear task structures. This approach helps prevent excessive stress while maintaining optimal productivity.

The significant mediating role of job stress in the relationship between work climate and performance underscores the urgent need to manage environmental and thermal conditions in production areas. A positive work climate—especially temperature control, ventilation, and overall work environment quality—can effectively reduce job stress and subsequently improve workers' performance. Industries with exposure to heat should prioritize environmental monitoring, heat-stress mitigation protocols, and scheduled recovery breaks. Creating a supportive psychosocial climate is equally important, as it enhances employees' well-being, reduces stress responses, and strengthens long-term organizational performance. Furthermore, the findings of this study have important implications for the development of community-based interventions and health technologies to reduce work stress and improve performance. Participatory approaches such as the development of community-based health applications have been shown to increase compliance, independence, and individual health management skills, making them applicable in the context of work stress management.<sup>(26)</sup> Psychological factors, such as internal locus of control, also play a significant role in shaping employees' proactive behavior in dealing with work pressure, so it is crucial for organizations to strengthen these positive psychological aspects through training and counseling.<sup>(27)</sup> From a work environment perspective, research on the risks of exposure to hazardous environments indicates that unhealthy environmental conditions have the potential to increase physiological and psychological burdens, necessitating companies to ensure a safe and low-risk work environment.<sup>(28)</sup> Furthermore, effective education, including through media such as educational booklets, has been shown to change behavior and increase adherence to healthy work practices, enabling adaptation in stress management programs and employee performance improvement.<sup>(29)</sup> Efforts to provide supporting facilities such as clean water quality and a healthy work environment can also strengthen the general health of workers, which ultimately has an impact on reducing stress and increasing performance.<sup>(30)</sup>

### Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to establish causal relationships, as data on variables were collected at a single point in time. Second, the study was conducted only among production workers at a single company, which may reduce the generalizability of the results to different sectors, job types, or organizational cultures. Third, several variables—including job stress and performance—were measured using self-report instruments, which may introduce response bias. Unmeasured factors such as organizational support, leadership style, and personal coping strategies may also influence the observed relationships but were not included in the analytical model.

## CONCLUSIONS

The results showed that age has no significant effect on job stress, but has a positive effect on performance both directly and through job stress. Gender affects job stress and performance directly, without the mediating

role of job stress. Physical workload has no direct effect, but has an indirect impact on performance through job stress. Meanwhile, mental workload increased job stress but did not affect performance. Work climate has an indirect effect on performance through job stress in a positive direction. Meanwhile, job stress is proven to play a role in improving performance, indicating the existence of eustress that can be utilized to boost employee productivity.

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