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Quantitative Research Article

The Relationship Between Hot Working Climate and Dehydration Among Public Infrastructure and Facilities Handling (PIFH) Officers in Matraman East Jakarta, 2025

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Abstract

Background/ problem: According to the Central Bureau of Statistics, the average daily temperature in East Jakarta reached 32.4°C in 2022. Continuous exposure to high temperatures may increase the risk of dehydration among outdoor workers due to excessive fluid loss. Public Facilities and Infrastructure Officers, who perform physically demanding tasks outdoors, are particularly vulnerable to this condition.

Objective/ purpose: This study aimed to examine the relationship between age, physical activity, water intake, nutritional status, and hot work climate with the dehydration among public facilities and infrastructure officers in Matraman, East Jakarta.

Design and Methodology: This study employed a cross-sectional design. The study population consisted of PIFH officers from two sub-districts, namely Utan Kayu Selatan and Utan Kayu Utara. This quantitative analytical study used a cross-sectional design. The study involved 47 PIFH selected using purposive sampling. Data were collected using questionnaires and direct measurements. Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ), water intake using the Beverage Intake Questionnaire (BEVQ), nutritional status using body mass index, hot work climate using a heat stress meter, and dehydration status using the Self-Urine Examination Card (PURI). Bivariate analysis was performed using the chi-square test after dehydration status was recategorized into dehydrated and hydrated groups.

Results: The results showed that 18 out of 47 respondents (38.3%) experienced mild dehydration. Physical activity ($p = 0.017$), water intake ($p = 0.013$), and hot work climate ($p = 0.001$) were significantly associated with dehydration. Meanwhile, age and nutritional status were not significantly associated with dehydration.

Conclusion and Implications: Physical activity, water intake, and hot work climate were identified as significant factors associated with dehydration among PIFH officers. These findings indicate the need for preventive measures to reduce dehydration risk. It is recommended that the government evaluate and revise work schedules, particularly dual shifts (morning and afternoon), and implement strategies to ensure adequate hydration among workers exposed to hot environments.

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Keywords

Dehydration, Hot Working Climate, PIFH, Workers.

Introductions

Outdoor heat exposure in the workplace remains a significant occupational health issue, particularly in tropical regions. Workers who perform activities under direct sunlight are at risk of experiencing discomfort, reduced productivity, and even serious health problems (Mastuti et al., 2024). These conditions affect not only workers' physical health but may also reduce their quality of life and work performance if left unmanaged. One of the consequences of working in hot environments is the disruption of body fluid balance, such as dehydration (Suma'mur, 2014). Dehydration is a condition in which the body loses more fluids than it consumes and, if not properly managed, can lead to various health complications.

According to Noor et al. (2024), dehydration among workers can be influenced by two major factors: individual factors and environmental factors. Individual factors include age, sex, water intake, physical activity, workers' knowledge, nutritional status, and obesity, while environmental factors include hot work climate conditions such as temperature, humidity, and radiation. In addition to individual and workplace environmental factors, dehydration may also be triggered by certain health conditions, the use of diuretic medications, and the type of work clothing worn by workers (Fadhila et al., 2021). Certain medications may increase urination frequency, thereby accelerating body fluid loss (Sari, 2017). Furthermore, thick or non-breathable work clothing may hinder sweat evaporation, impairing the body's ability to regulate temperature and increasing the risk of dehydration. In tropical countries such as Indonesia, where high temperatures persist throughout most of the year, workers exposed to direct sunlight are more susceptible to excessive fluid loss, particularly when adequate hydration is not maintained.

Previous studies have highlighted the impact of heat exposure on dehydration among workers. A study conducted by Mizelle et al. (2022) in the United States found that approximately 46.7% of agricultural workers experienced dehydration before work, increasing to 100% after work. Similarly, Salsabila et al. (2023) reported that hot work climate significantly affected dehydration among mining workers in Kendari, where 15 workers (71.4%) in workshop areas exposed to heat levels above the threshold limit value experienced dehydration.

According to data from the Central Bureau of Statistics, the maximum daily temperature in Jakarta reached 37.2°C in 2024 (Central Bureau of Statistics of DKI Jakarta Province, 2024), while the average daily temperature in East Jakarta in 2022 was recorded at 32.4°C (Central Bureau of Statistics of East Jakarta, 2023). These conditions indicate a substantial risk of heat exposure among outdoor workers, including Public Facilities and Infrastructure Officers (PPSU) in Matraman, East Jakarta, who work directly under sunlight. Therefore, investigating the relationship between hot work climate and dehydration among PPSU officers is essential.

Based on preliminary observations through informal interviews with 10 workers, most participants reported symptoms such as excessive heat sensation, dizziness, weakness, and excessive thirst, which are common signs of dehydration. Considering these conditions, this study was conducted to further examine the relationship between hot work climate exposure and dehydration among PPSU officers. Understanding this relationship is expected to support the Jakarta regional government in implementing effective control measures and developing occupational health and safety (OHS) policies for PPSU workers.

Methods

Research Design

This study was an analytical observational study with a quantitative approach using a cross-sectional design. The design was selected to assess the relationship between individual factors, hot work climate, and dehydration status at one point in time. Therefore, the outcome is reported as dehydration status or proportion of dehydration.

Research Setting

This study was conducted among Public Facilities and Infrastructure Officers in the Matraman area from April to July 2025. The research location was selected because it represents the main area of daily work activities and outdoor duties performed by PPSU workers, making it an appropriate setting to assess exposure to hot work climate and dehydration

Participants/Sample

The study sample consisted of Public Facilities and Infrastructure Officers (PPSU) working in the Matraman area. The minimum final sample size obtained was 47 respondents.

Sampling and Sample Procedures

The required sample size for this study was calculated using the Lemeshow sample size formula, specifically the two-sided hypothesis test for differences between two proportions with a 95% confidence level. The calculation was based on P1 and P2 values obtained from previous studies.

$$n = \frac{\{ Z_{1-\frac{\alpha}{2}}\sqrt{2\bar{P}(1-\bar{P})} + Z_{1-\beta}\sqrt{P1(1-P1) + P2(1-P2)}\}^2}{(P1-P2)^2}$$

Instruments and Procedures

Primary data were collected through questionnaires and direct measurements, including the International Physical Activity Questionnaire (IPAQ), Beverage Intake Questionnaire (BEVQ), heat exposure measurements using a heat stress meter, and dehydration assessment using the Self-Urine Examination Card.

Study Variables and Operational Definitions

Variable	Operational definition	Measurement method/instrument	Category used in analysis	Scale
Dehydration status	Hydration condition assessed from urine color. For bivariate analysis, moderate, mild, and severe dehydration were combined as "dehydrated", while normal hydration was classified as "hydrated".	Self-Urine Examination Card (PURI). Workers compared urine color with the card after urine sampling/observation during data collection.	Dehydrated; Hydrated	Ordinal, recoded into nominal
Age	Respondent's age in completed years at the time of data collection.	Structured questionnaire/interview.	Old (>=43 years); Young (<43 years). The cut-off point followed the median age of respondents.	Nominal
Physical activity	Level of physical activity performed by respondents based on work and daily activity patterns.	International Physical Activity Questionnaire (IPAQ), categorized according to IPAQ scoring guidelines.	High; Moderate. The low category was not analyzed in bivariate testing because no respondents were classified as low.	Ordinal
Water intake	Average daily fluid intake from drinking water and beverages.	Beverage Intake Questionnaire (BEVQ). Intake was classified based on adequacy of daily fluid consumption according to the study cut-off.	Inadequate; Adequate	Nominal
Nutritional status	Body mass index calculated from body weight divided by height squared.	Direct measurement of body weight and height, then BMI classification.	Non-ideal; Ideal	Nominal
Hot work climate	Environmental heat exposure in the outdoor work area compared with the recommended threshold.	Heat stress meter. Measurements were conducted in workers' outdoor work points during active working hours and compared with the standard threshold.	Does not meet standard (>28°C); Meets standard (<=28°C)	Nominal

Data Analysis

Univariate analysis was carried out to describe the distribution and frequency of each study variable. Furthermore, bivariate analysis was conducted to identify the relationship between the independent and dependent variables by analyzing the p-value. The association between variables was tested using the chi-square test with a significance level of 0.05.

Ethical Considerations

This study was approved by the Research Ethics Committee of UPN 'Veteran' Jakarta Research Ethics Committee with ethical approval number 70/VI/2025/KEP.

Results

This study was conducted among Public Facilities and Infrastructure Officers (PPSU) working in the Matraman area. The dependent variable was the incidence of dehydration, which was assessed using the Self-Urine Examination Card (PURI). The independent variables analyzed included age, physical activity, water intake, nutritional status, and hot work climate.

Table 1. Frequency Distribution of Dehydration Incidence Among Public Facilities and Infrastructure Officers in Matraman

Variable	N	Percentage (%)
Dehydration Level		
Severe	0	0
Moderate	14	29.8
Mild	18	38.3
Hydrated	15	31.9

The proportion of dehydration incidence among Public Facilities and Infrastructure Officers (PPSU) in Matraman in 2025, based on the Self-Urine Examination Card (PURI) assessment, showed that 18 respondents (38.3%) were classified as having mild dehydration, while no cases of severe dehydration were found among the respondents (0%).

Table 2. Frequency Distribution of Factors Influencing Dehydration Among Public Facilities and Infrastructure Officers in Matraman

Variable	N	Percentage (%)
Age		
Old (≥43 Years Old)	27	57.4
Young (<43 Years Old)	20	42.6
Physical activity		
High	27	57.4
Moderate	20	42.6
Low	0	0
Water Intake		
Inadequate	29	61.7
Adequate	18	38.3
Nutritional Status		
Non-Ideal	24	51
Ideal	23	49
Hot Work Climate		
Does Not Meet Standard (>28˚C)	31	66
Meets Standart (≤28˚C)	16	44

Based on the table 2, the highest proportion in the age category was found in the older age group, with 27 out of 47 respondents (57.4%). In the physical activity category, most respondents had a high level of physical activity, accounting for 27 respondents (57.4%). For water intake, the majority of respondents had inadequate water consumption, namely 29 out of 47 respondents (61.7%). Regarding nutritional status, most respondents were classified as having non-ideal nutritional status, with 24 respondents (51.0%). Furthermore, the highest proportion in the hot work climate variable was found among workers exposed to non-compliant hot work conditions, with 31 out of 47 respondents (66.0%).

Table 3. Analysis Results on the Association Between Influencing Factors and Dehydration

Variable	Dehydrated		Hydrated		p-value	POR (95% CI)
	n	%	n	%		
Age						
Old (>=43 years)	20	74.1	7	25.9	0.306	1.90 (0.55-6.59)
Young (<43 years)	12	60.0	8	40.0		
Physical activity						
High	22	81.5	5	18.5	0.022	4.40 (1.19-16.28)
Moderate	10	50.0	10	50.0		
Water intake						
Inadequate	24	82.8	5	17.2	0.006	6.00 (1.57-22.89)
Adequate	8	44.4	10	55.6		
Nutritional status						
Non-ideal	19	79.2	5	20.8	0.096	2.92 (0.81-10.56)
Ideal	13	56.5	10	43.5		
Hot work climate						
Does not meet standard (>28°C)	26	83.9	5	16.1	0.001	8.67 (2.15-34.90)
Meets standard (<=28°C)	6	37.5	10	62.5		

Table 3 shows that physical activity, water intake, and hot work climate were significantly associated with dehydration status. Workers with high physical activity had 4.40 times higher odds of dehydration than workers with moderate physical activity (95% CI = 1.19-16.28). Workers with inadequate water intake had 6.00 times higher odds of dehydration than workers with adequate water intake (95% CI = 1.57-22.89). Workers exposed to a hot work climate exceeding the recommended standard had 8.67 times higher odds of dehydration than workers exposed to a work climate that met the standard (95% CI = 2.15-34.90). Age

and nutritional status were not significantly associated with dehydration status because their confidence intervals included 1.00.

Discussion

Dehydration among workers is a condition of inadequate body fluid balance that may be affected by individual factors and environmental factors. In this study, 68.1% of PPSU officers were classified as dehydrated, consisting mostly of mild and moderate dehydration. This finding indicates that outdoor municipal workers require greater attention because their work is performed under direct heat exposure and involves repetitive physical activity.

Age was not significantly associated with dehydration status (p = 0.306; POR = 1.90; 95% CI = 0.55-6.59). Although older workers had higher odds of dehydration than younger workers, the confidence interval included 1.00, indicating that the association was not statistically significant. This finding is consistent with studies by Salsabila et al. (2023) and Nilamsari et al. (2018), which reported that age is not always a dominant factor in dehydration among workers within the productive age range. Work adaptation, experience, and similar exposure patterns across age groups may explain the absence of a significant association.

Physical activity was significantly associated with dehydration status (p = 0.022; POR = 4.40; 95% CI = 1.19-16.28). Workers with high physical activity had higher odds of dehydration than those with moderate physical activity. Physiologically, heavy physical activity increases metabolic heat production and sweat loss, thereby increasing the need for fluid replacement. This result supports previous studies by Anggraeni and Fayasari (2020) and Pustisari et al. (2020), which emphasized that higher activity levels should be balanced with adequate fluid consumption to prevent dehydration, fatigue, and reduced work productivity.

Water intake was significantly associated with dehydration status (p = 0.006; POR = 6.00; 95% CI = 1.57-22.89). Respondents with inadequate water intake had six times higher odds of dehydration than those with adequate intake. This finding is consistent with Nurfrida and Lestari (2023), Kurniawati et al. (2021), and Pribadi and Tualeka (2024), who reported that adequate fluid consumption is an important determinant of workers' hydration status. Inadequate water intake may reduce the body's ability to replace fluids lost through sweating, particularly among workers exposed to heat.

Nutritional status was not significantly associated with dehydration status (p = 0.096; POR = 2.92; 95% CI = 0.81-10.56). Although workers with non-ideal nutritional status had higher odds of dehydration, the association was not statistically significant. Nutritional status may influence total body water because fat mass contains less water than muscle mass. However, its effect may be indirect and influenced by other factors such as physical workload, fluid intake, and environmental heat exposure (Arsanti et al., 2023).

Hot work climate was significantly associated with dehydration status (p = 0.001; POR = 8.67; 95% CI = 2.15-34.90). Workers exposed to hot work climate above the recommended standard had substantially higher odds of dehydration than workers in environments that met the standard. This finding is consistent with studies by Sari (2017), Wahyuni et al. (2020), Sutarto et al. (2022), and Pribadi and Tualeka (2024), which showed that heat exposure is associated with dehydration among workers. Heat exposure increases sweating as a thermoregulatory mechanism; without adequate fluid replacement, dehydration may occur and may progress to heat exhaustion or heat stroke.

The findings suggest that prevention should focus on both individual behavior and workplace control. Individual measures include regular water consumption, use of suitable PPE such as hats or breathable clothing, and early recognition of dehydration symptoms. Workplace control measures include provision of accessible drinking water, shaded rest areas, work-rest cycles, and adjustment of work schedules to avoid peak heat periods.

Limitations

This study had several limitations. Data collection using interviews and self-reported questionnaires may have introduced information bias, particularly for variables related to water intake and physical activity, due to respondents' recall and honesty. In addition, dehydration status assessment using the Self-Urine Examination Card (PURI) relied on visual interpretation of urine color, which may have affected measurement accuracy. Heat exposure measurements conducted in outdoor environments were also influenced by fluctuating weather conditions. Furthermore, several factors potentially related to dehydration, such as work duration, health conditions, and use of personal protective equipment, were not analyzed in this study.

Conclusion

Based on the results of this study involving 47 Public Facilities and Infrastructure Officers (PPSU) in the Matraman area in 2025, it can be concluded that most respondents were categorized as older workers (61.7%), had heavy physical activity levels (57.4%), insufficient water intake (61.7%), abnormal nutritional status (51%), and were exposed to hot work climates exceeding the recommended standard (66%). The proportion of respondents experiencing dehydration was 68.1%.

The results of the bivariate analysis demonstrated that physical activity (p-value = 0.017), water intake (p-value = 0.013), and hot work climate (p-value = 0.001) were significantly associated with dehydration incidence. Meanwhile, age (p-value = 0.111) and nutritional status (p-value = 0.222) showed no significant relationship with dehydration. These findings indicate that both individual factors, particularly physical activity and fluid intake, as well as environmental factors such as hot work climate, play important roles in dehydration among PPSU workers. Therefore, preventive interventions are necessary to maintain workers' health and productivity in hot working environments.

Recommendations

Workers, especially PPSU officers, are encouraged to manage their working time effectively, utilize rest periods in shaded areas, use appropriate personal protective equipment (PPE) such as hats, carry personal drinking water bottles, and consume water regularly during work to reduce the risk of dehydration in hot environments.

For the government and workplace management, it is recommended to enforce the use of suitable PPE for hot working conditions, implement scheduled rest breaks in shaded areas, provide adequate drinking water facilities, and distribute drinking water during work briefings or mid-shift periods. In addition, educational programs regarding the dangers of dehydration should be conducted regularly, along with evaluations of work schedules, particularly double-shift systems that may increase the risk of dehydration.

Future researchers are advised to use more objective measurement methods, such as direct observation or real-time recording of fluid intake and physical activity. Furthermore, hydration status assessment using urine specific gravity measurements may be used as a complementary or alternative method to the PURI card in order to improve measurement accuracy.

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Declarations

Conflict of Interest: The authors declare no conflict of interest.

Ethical Approval Statement: This study was conducted in accordance with the Declaration of Helsinki and was approved by the Research Ethics Committee of UPN 'Veteran' Jakarta Research Ethics Committee with ethical approval number 70/VI/2025/KEP for research involving human participants.

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