

Occupational Heat Stress Exposure and Associated Health Symptoms Among Workers in A Paint Manufacturing Facility in Klang, Selangor

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Structured Abstract

Background: The rise in global temperatures and frequent extreme heat events due to climate change have raised concerns about heat-related illnesses among industrial workers. In Malaysia's tropical climate, workers in enclosed manufacturing environments face a higher risk of heat stress, especially when performing strenuous tasks or wearing protective gear. This study focuses on the paint manufacturing industry, where high indoor temperatures are common in sections such as wet paint, raw material, and powder coating. The Wet Bulb Globe Temperature (WBGT) index was used to assess environmental heat stress, while the Work-Related Heat Stress Questionnaire (WHSTQ) was used to identify symptoms experienced by workers. The aim of this study is to evaluate heat stress levels across different work sections and examine their relationship with self-reported symptoms to improve workplace safety and health standards.

Methods: Heat stress assessment was conducted through preliminary walkthrough observations in a paint manufacturing factory. Environmental monitoring was done using the Wet Bulb Globe Temperature (WBGT) method to measure heat levels in various sections. Personal monitoring of workers was carried out to validate exposure conditions. Data on worker symptoms and perceptions were collected through observations and feedback. WBGT readings were analyzed and compared with DOSH guidelines. Heat stress symptoms were identified using the Work-Related Heat Stress Questionnaire (WHSTQ). A correlation between WBGT values and self-reported symptoms was then analyzed to identify high-risk areas for targeted intervention.

Results: The study found that the raw materials section recorded the highest WBGT value at 32.7 °C (SD = 1.799), exceeding the TLV of 28.5 °C, indicating severe heat stress. Among 60 workers, thirst (95%) and excessive sweating (81.5%) were the most reported symptoms. Spearman correlation analysis revealed strong associations between WBGT levels and symptoms, particularly thirst ($r = 0.71$, $p = 0.001$) and sweating ($r = 0.68$, $p = 0.001$). These results highlight the need for workplace improvements such as ventilation, rest breaks, and hydration to reduce heat-related health risks.

Conclusion: This study found that heat stress levels varied by department, with the raw material section having the highest WBGT (32.7°C), exceeding the TLV of 28.5°C. The most reported symptoms were thirst (>90%) and excessive sweating (>80%), followed by muscle cramps and skin rash. A strong correlation was found between WBGT levels and symptoms, especially thirst ($r = 0.71$) and sweating ($r = 0.68$), indicating significant heat-related health risks.

Keywords: Heat stress, Wet Bulb Globe Temperature (WBGT), Occupational health, Paint manufacturing, Self-reported symptoms

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