

Occupational Heat Stress and Physiological Responses Among Industrial Workers: A Scoping Review of Warehouse Environments in Hot-Humid Climates

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Structured Abstract

Background: Warehouse workers in hot and humid regions face increasing risks of occupational heat stress, yet limited research has focused on indoor industrial environments compared to outdoor sectors. This scoping review aimed to explore existing evidence on heat stress-related risk factors, physiological responses and mitigation strategies among industrial workers in warehouse settings.

Methods: A systematic search was conducted using major databases to identify peer-reviewed studies published between 2014 and 2025. Eligibility was based on studies that focused on indoor occupational settings, particularly warehouse environments, with data on heat stress factors, physiological outcomes, or mitigation interventions.

Results: A total of 36 studies were included, encompassing various study designs and geographic locations. Key occupational risk factors identified included high indoor ambient temperatures (ranging from 28.1°C to 36.7°C), poor air circulation, prolonged working hours (up to 12 hours per shift), and use of impermeable PPE. Physiological responses reported across studies showed elevated core body temperatures (range 37.5°C–42.7°C), increased heart rates (range 81–98.6 bpm), decreased blood pressure (systolic: 118.3–122.5 mmHg; diastolic: 78.5–82.5 mmHg), and substantial fluid loss through sweat rate and body weight reduction. Mitigation strategies such as engineering controls (e.g., ventilation, cooling systems), administrative controls (e.g., hydration programs, adjusted work-rest cycles), and wearable monitoring devices were evaluated, though effectiveness varied across settings.

Conclusion: In conclusion, occupational heat stress in warehouses poses significant health and safety risks, especially in tropical climates. There is a critical need for comprehensive, evidence-based interventions integrating environmental control, health monitoring, and policy enforcement to protect worker health and productivity.

Keywords: Occupational heat stress, hot and humid climate, physiological responses, risk factors, mitigation strategies

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