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# Urban Heat Island and Outdoor Thermal Comfort in Residential Area Shah Alam Selangor

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**Structured Abstract**

**Background:** This study examines the Urban Heat Island (UHI) phenomenon and its impact on outdoor thermal comfort (OTC) in residential areas of Shah Alam, Selangor. Rapid urbanization and industrialization have intensified UHI effects, leading to elevated temperatures in urban areas compared to their rural surroundings. Shah Alam, characterized by its dense infrastructure and limited green spaces, experiences significant UHI impacts, adversely affecting thermal comfort and residents' well-being. The study focuses on quantifying UHI intensity, assessing OTC levels, and exploring the relationship between these factors to provide actionable recommendations for mitigating heat-related discomfort and enhancing urban resilience.

**Methods:** A cross-sectional survey design was used, incorporating meteorological data from April to September 2024 collected from Subang (urban) and Pusat Latihan Pertanian Kalumpang (rural) stations. Subjective data on thermal comfort were obtained through questionnaires distributed to 264 participants in key urban locations, such as recreational areas, institutional zones, and commercial centers. Physiological Equivalent Temperature (PET) values were calculated using RayMan software, integrating meteorological and personal data to evaluate thermal stress. Statistical analyses were conducted using SPSS to identify correlations between UHI intensity and OTC levels.

**Results:** This study revealed a mean UHI intensity of 1.74°C, with PET values ranging from 24.50°C to 32.0°C and a mean PET of 28.94°C, indicating moderate heat stress across urban locations. A significant positive correlation ($r = 0.403$, $p < 0.001$) was observed between UHI intensity and PET, underscoring the influence of urbanization on thermal comfort. Approximately 56.83% of participants reported experiencing "warm" conditions, correlating with moderate physiological heat stress. Variations in UHI intensity and OTC levels were influenced by urban density, vegetation cover, meteorological factors, and microclimatic conditions, such as reduced wind speed and increased relative humidity.

**Conclusion**: The study underscores the need for sustainable urban planning to mitigate UHI effects and improve OTC. Recommendations include expanding urban greenery, incorporating shaded structures, using heat-reflective materials, and optimizing urban designs for natural ventilation. These strategies aim to reduce thermal discomfort, enhance residents' quality of life, and promote sustainable urban resilience in Shah Alam.

**Keywords:** Urban heat island, outdoor thermal comfort, Shah Alam, sustainable urban planning, physiological equivalent temperature, urban greenery.

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