

Clothing-Based Heat-Stress Intervention Using Lightweight Infrared-Transparent Apparel

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Global temperatures continue to rise due to climate change, making heat stress a growing health and occupational risk as sustained high temperatures hurt work capacity and increase injuries and illness. While conventional cooling strategies such as air conditioning systems are widespread, they are also highly energy inefficient and inaccessible to vulnerable populations, which emphasizes the need for individualized garment-based cooling solutions. The purpose of this clinical study was to evaluate the efficacy of passive radiative cooling garments to reduce heat stress and perceived thermal discomfort compared with a cotton control during controlled radiant and humid heat exposure. Fifteen healthy male participants were enrolled in a randomized crossover study, with participants randomly assigned to wear either the experimental cooling garment or the cotton control during their first session and then the other garment approximately one week later. During each session, participants underwent a simulated heat stress protocol in an environmental chamber consisting of sedentary rest and exercise phases during which physiological measures were assessed. Sweat and urine samples were collected, infrared thermal imaging was performed, and participants completed questionnaires assessing heat-related symptoms, thermal sensation, and garment comfort. At this time, the study is underway with participants completing their two sessions a week apart. After completion of trials, physiological and survey data will be analyzed to assess whether the experimental garment reduces heat strain in comparison with the matched cotton control, providing insights into more feasible and sustainable methods of combatting extreme heat. This project is supported by NIH R25ES020721.

