

Perceptual and physiological heat strain: Examination in firefighters in laboratory- and field-based studies

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Firefighting demands performing heavy muscular work under adverse and potentially dangerous conditions. Although the physiological and psychological responses to simulated firefighting activities have been described, the heat strain has not been characterised using standardised indices of exercise–heat strain. The purpose of the study is to describe the physiological and perceptual strain associated with working in personal protective equipment and performing simulated firefighting activities in a hot environment using recently developed strain indices (Physiological Strain Index (PhSI); Perceptual Strain Index (PeSI)). Data from two previously published studies (Smith *et al.* 1995, 2001) – one a laboratory-based study and one a field-based study – were re-analysed incorporating the strain indices. The laboratory study involved walking on a treadmill for 15 min while wearing three different clothing and equipment configurations. The field study involved three trials of standardised firefighting tasks in a live-fire training structure (mean trial length = 5.76 min). Heart rate, rectal temperature, thermal sensations and ratings of perceived exertion were collected in each study. PhSI and PeSI values were calculated using the formulae developed by Moran *et al.* (1998b) and Tikuisis *et al.* (2002), respectively. PhSI and PeSI increased significantly over time in both studies. Even relatively brief bouts of exercise while wearing heavy impermeable clothing or simulated firefighting activity in the heat results in moderate to high levels of heat strain as assessed by PhSI and PeSI.

Keywords: physiological strain index; psychological strain index; firefighting; personal protective equipment