

Effect of exercise, heat stress and dehydration on myocardial performance

P. C. Fehling¹, J. M. Haller¹, W. K. Lefferts¹, E. M. Hultquist¹, M. Wharton², T. W. Rowland¹ and D. L. Smith¹

¹First Responder Health and Safety Laboratory, Department of Health and Exercise Sciences, Skidmore College, Saratoga Springs, NY 12866, USA, ²Saratoga Hospital, Saratoga Springs, NY 12866, USA.

Correspondence to: D. L. Smith, Department of Health and Exercise Sciences, Skidmore College, 815 North Broadway, Saratoga Springs, NY 12866, USA. Tel: +1 518 580 5389; fax: +1 518 580 8356; e-mail: dsmith@skidmore.edu

Background	Myocardial dysfunction is a well-documented outcome of extended periods of high cardiac output. Whether similar effects occur during firefighting, an occupation characterized by repeated periods of work compounded by dehydration and heat stress, is uncertain.
Aims	To investigate the independent and combined effects of moderate heat stress and dehydration on indicators of myocardial performance following intermittent, submaximal treadmill exercise while wearing personal protective equipment (PPE).
Methods	Twelve aerobically fit young men (age 21.5 ± 2.6 years; maximal oxygen uptake $[\text{VO}_{2\text{max}}]$ 60.3 ± 4.4 ml $\text{kg}^{-1} \text{min}^{-1}$) performed intermittent treadmill walking exercise consisting of three 20 min bouts at an intensity of $\sim 40\%$ $\text{VO}_{2\text{max}}$ separated by two periods of rest in four different conditions in random order: (i) no heat stress-euhydrated, (ii) heat stress-euhydrated (heat stress created by wearing PPE), (iii) no heat stress-dehydrated and (iv) heat stress-dehydrated. We measured core temperature by a telemetric gastrointestinal pill. We determined cardiac variables by standard echocardiographic techniques immediately before and ~ 30 min after exercise.
Results	We recorded no significant changes in markers of systolic (ejection fraction, shortening fraction, tissue Doppler- <i>S</i>) or diastolic (mitral peak <i>E</i> velocity, tissue Doppler- <i>E'</i> and <i>E/E'</i>) function following exercise in any of the four conditions.
Conclusions	In this model of exercise designed to mimic the work, heat stress and dehydration associated with firefighting activities, we observed no negative effects on myocardial inotropic or lusitropic function.
Key words	Cardiac strain; diastolic function; firefighting; heat stress; systolic function.