Costello et al. Extreme Physiology & Medicine 2015, 4(Suppl 1):A79
http://www.extremephysiolmed.com/content/4/S1/A79

Extreme Physiology & Medicine

MEETING ABSTRACT Open Access

Inside the 'Hurt Locker': the combined effects of explosive ordnance disposal and chemical protective clothing on physiological tolerance time in extreme environments

Joseph T Costello[1,2*], Kelly L Stewart[2], Ian B Stewart[2]

From 15th International Conference on Environmental Ergonomics (ICEE XV)
Portsmouth, UK. 28 June - 3 July 2015

Introduction

Explosive ordinance disposal (EOD) technicians are often required to wear specialised clothing combinations that not only protect against the risk of explosion but also potential chemical contamination. This heavy (>35 kg) and encapsulating ensemble is likely to increase physiological strain by increasing metabolic heat production and impairing heat dissipation [1,2]. This study investigated the physiological tolerance times of two different chemical protective undergarments (2.9 kg v's 4.2 kg), commonly worn with EOD personal protective clothing, in a range of simulated environmental extremes and work intensities.

Methods

Seven males performed eighteen trials wearing two ensembles. The trials involved walking on a treadmill at 2.5, 4 and 5.5 km.h^{-1} at each of the following environmental conditions, 21 °C, 30 °C and 37 °C wet bulb globe temperature (WBGT). The trials were ceased if the participants' gastrointestinal temperature reached 39 °C, if heart rate exceeded 90 % of maximum, if walking time reached 60 minutes or due to volitional fatigue.

Results

Physiological tolerance times ranged from 8 to 60 min and the duration (Figure 1, mean difference: 2.78 min,

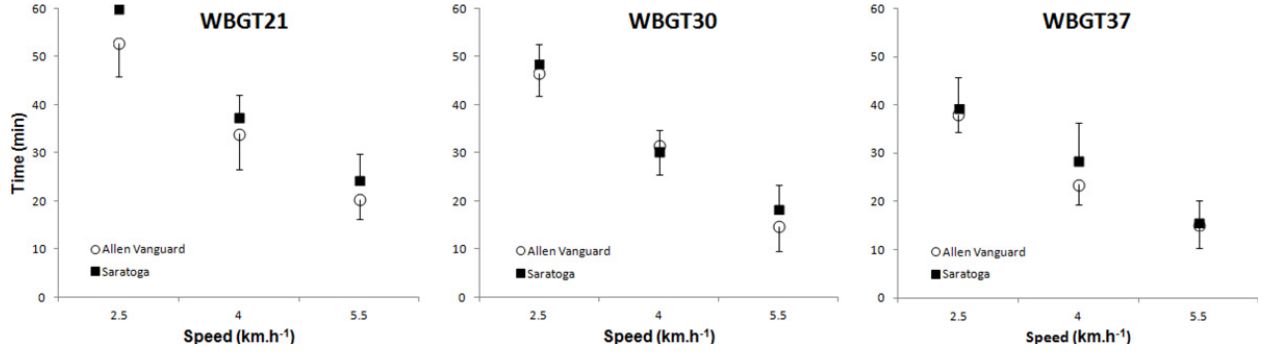

Figure 1 Tolerance time (mean ± SD) in both ensembles across the different environmental conditions and work rates.

* Correspondence: joe.costello@port.ac.uk
[1]Extreme Environments Laboratory, Department of Sport and Exercise Science, University of Portsmouth, Portsmouth, UK
Full list of author information is available at the end of the article

P > 0.05) were similar in both ensembles. A significant effect for environment (21>30>37°C WBGT, P < 0.05) and work intensity (2.5>4>5.5 $km.h^{-1}$, P < 0.05) was observed in tolerance time. The majority of trials across both ensembles (101/126; 80.1%) were terminated due to participants achieving a heart rate equivalent to greater than 90% of their maximum.

Discussion and conclusion

This is the first study to systematically compare the physiological tolerance times of two air-permeable, charcoal-impregnated chemical protective undergarments while worn in combination with EOD personal protective clothing. Physiological tolerance times wearing these two ensembles were similar and predominantly limited by cardiovascular strain.

Authors' details
[1]Extreme Environments Laboratory, Department of Sport and Exercise Science, University of Portsmouth, Portsmouth, UK. [2]School of Exercise and Nutrition Sciences and Institute of Health and Biomedical Innovation, Kelvin Grove, Queensland University of Technology, QLD 4059, Australia.

Published: 14 September 2015

References

1. Stewart IB, Stewart KB, Worringham CJ, Costello JT: **Physiological tolerance times while wearing explosive ordnance disposal protective clothing in simulated environmental extremes.** *PLoS ONE* 2014, **9(2)**:e83740, doi:10.1371/journal.pone.0083740.
2. Stewart IB, Townshend A, Rojek A, Costello JT: **Bomb Disposal in the Tropics: A cocktail of Metabolic and Environmental Heat.** *Journal of Ergonomics* 2013, S:2[http://dx.doi.org/10.4172/2165-7556.S2-001].

doi:10.1186/2046-7648-4-S1-A79
Cite this article as: Costello *et al.*: Inside the 'Hurt Locker': the combined effects of explosive ordnance disposal and chemical protective clothing on physiological tolerance time in extreme environments. *Extreme Physiology & Medicine* 2015 **4**(Suppl 1):A79.