

MEETING ABSTRACT

Open Access

Hyperthermia exaggerates exercise-induced aggregation of blood platelets

Jung-Hyun Kim*, Tianzhou Wu, Raymond Roberge, Aitor Coca

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

Introduction

Acute exposure to exertional exercise/heavy physical work often triggers cardiovascular events in which exercise-induced platelet aggregation, blood coagulation, and disruption in fibrinolysis may adversely affect atherothrombotic disease. Elevated body temperature, commonly accompanied with prolonged exercise, was suggested as an auxiliary factor for exercise-induced platelet aggregation [1]. Recent studies also showed platelet hyperaggregation following firefighting activities combining heavy physical work and heat stress [2], [3]. However, the influence of hyperthermia separated from physical exercise impact on platelet aggregation is unclear.

Methods

Twelve healthy men; age 22.8 (1.3) years and VO_{2max} 56.8 (6.2) $ml.kg^{-1}.min^{-1}$, underwent three experimental trials: exercise hyperthermia (ExHT), passive hyperthermia (PaHT), and control exercise (CONT). Subjects performed a treadmill exercise at 60 % VO_{2max} in the heat (35 °C, 50 % RH) until their rectal temperature (T_{re}) increased 1.5 °C above the resting baseline (ExHT) or performed a control exercise at the same intensity and duration according to ExHT in a cooler condition (23 °C, 50 % RH) (CONT). In PaHT, subjects were passively heated using a water garment (45 °C) in the heat (45 °C, 50 % RH) until T_{re} increased 1.5 °C above baseline. Platelet aggregation was assessed from antecubital venous blood collected during baseline (Base), end-trial (End), and again following 1 hour of passive recovery (Rec) (23 °C, 50 % RH), using a platelet function analyser providing a closure time (CT: second) through an in-vitro simulation of platelet adhesion, activation, and aggregation. Decreased CT is

an indicative of increased platelet aggregation. Dependent variables were analysed using a two-way repeated measures ANOVA.

Results

Under the study conditions, T_{re} ($F = 13.2, p < 0.001$) and skin temperature ($F = 97.3, p < 0.001$) increased significantly in ExHT and PaHT compared to CONT, whereas heart rate was significantly higher in ExHT and CONT compared to PaHT ($F = 40.0, p < 0.001$). CT in exposure to Collagen/ADP showed a decreasing trend over time in ExHT and PaHT and significantly differed from CONT at Rec ($F = 7.6, p = 0.008$). CT in exposure to Collagen/Epinephrine showed a similar response to Collagen/ADP, but did not significantly differ among conditions ($F = 3.5, p = 0.075$), though CT in ExHT significantly decreased at End compared to CT in CONT ($p = 0.046$).

Discussion

Moderate exercise in the heat (ExHT) significantly elevated platelet aggregation as indicated by decreased CT whereas CT was not altered in non-hyperthermia exercise condition (CONT). PaHT showed an overall decreasing trend of CT toward End and Rec, but its impact on platelet aggregation was not significant in response to C/EPI in this study.

Conclusion

It was concluded that hyperthermia exaggerates exercise-induced platelet aggregation as an auxiliary factor, but the effect of hyperthermia alone on platelet aggregation in young, healthy subjects is minimal. Further research is warranted to investigate a physiological mechanism responsible for hyperthermia induced-platelet hyperreactivity.

* Correspondence: inr3@cdc.gov

National Personal Protective Technology Laboratory, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Pittsburgh, PA, USA

Disclaimer

The findings and conclusions of this abstract are those of the authors and do not necessarily reflect the views of the National Institute for Occupational Safety and Health.

Published: 14 September 2015

References

1. El-Sayed MS, Ali N, El-Sayed Ali Z: **Aggregation and activation of blood platelets in exercise and training.** *Sports Med* 2005, **35**(1):11-22.
2. Smith DL, *et al*: **Effect of live-fire training drills on firefighters' platelet number and function.** *Prehosp Emerg Care* 2011, **15**(2):233-9.
3. Hostler D, *et al*: **A randomized controlled trial of aspirin and exertional heat stress activation of platelets in firefighters during exertion in thermal protective clothing.** *Prehosp Emerg Care* 2014, **18**(3):359-67.

doi:10.1186/2046-7648-4-S1-A153

Cite this article as: Kim *et al*: Hyperthermia exaggerates exercise-induced aggregation of blood platelets. *Extreme Physiology & Medicine* 2015 **4**(Suppl 1):A153.

**Submit your next manuscript to BioMed Central
and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.biomedcentral.com/submit

