

# Effects of wearing protective clothing on the thermoregulatory characteristics of junior surf lifesavers

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## Introduction

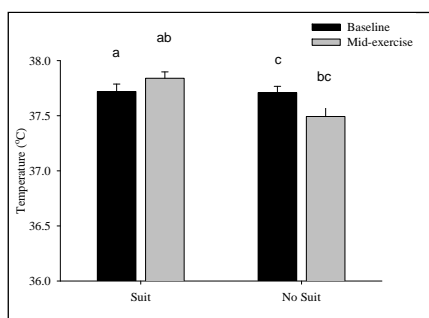
Prepubescent children are disadvantaged when exercising in hot environments due to age and maturation related differences when compared to adults<sup>1</sup>. Children produce greater metabolic heat, have a reduced sweating capacity and cardiac output and experience a greater potential for heat influx when ambient temperatures exceed that of the skin<sup>1</sup>. Previous studies investigating thermoregulatory responses of prepubescent children have predominantly explored hot/dry environments with limited research in hot/humid environments or exercising in clothing under any climatic conditions. A unique situation exists for north Queensland surf lifesavers, in which they are compelled to wear full-length protective suits to prevent potentially fatal marine stinger envenomation. This research evaluates the thermoregulatory responses *in situ*, of prepubescent junior surf lifesavers exercising in hot and humid conditions while wearing tight fitting protective clothing. This research explores the hypothesis that thermoregulatory characteristics of prepubescent surf lifesavers increase while exercising in a hot/humid environment wearing tight fitting protective clothing.

## Methods

This study included field and climate control chamber interventions using actual and simulated junior surf lifesaving activities respectively and participants were requested to attend each study twice, once wearing a full-length protective Lycra garment (S) and once wearing only their normal swimwear (NS). The field study consisted of simulated surf lifesaving activities identical to those undertaken during their weekend activities including beach and water events. Participants (13 female, 7 male; mean  $\pm$  SE age  $9.7 \pm 0.4$  yr) were divided into age groups while their parents or guardians completed written informed consent forms in accordance with the James Cook University Human Ethics Committee. Assessments were conducted baseline, mid-exercise after beach events and post-exercise after water events. The chamber study involved participants (5 female, 6 male; mean  $\pm$  SE age  $9.5 \pm 0.5$  yr) undertaking a lower-body exercise protocol in  $32^{\circ}\text{C}$ ,  $\approx 25^{\circ}\text{C}$  black globe temp. and 70% r.h. designed to replicate beach events. The protocol included 10 min seated rest followed by three bouts of cycling with 5 min rest between bouts. Each bout consisted of 5 min of continuous cycling at a workload equivalent to 60% age-predicted  $\text{HR}_{\text{MAX}}$  followed by three 20 s sprints. For each sprint, participants were instructed to cycle about as fast as they would run in a beach sprint. Assessments were taken at 5 min intervals while in the chamber. Parameters assessed included core body temp. ( $T_{\text{C}}$ ), skin temp. ( $T_{\text{SK}}$ ), skin blood flow, HR, sweat loss and urine specific gravity. Analysis of data was conducted via three-way repeated measures ANOVA (gender x suit x time) and Friedman's test for all non-parametric data and alpha set to 0.05. Transformation of raw data was attempted on data not distributed normally to achieve normal distribution.

## Results

In the field, there was a main effect of suit for  $T_{\text{C}}$  with S ( $37.78 \pm 0.06^{\circ}\text{C}$ ) greater than NS ( $37.60 \pm 0.07^{\circ}\text{C}$ ;  $p=0.011$ ) as well as with respect to time after the beach events ( $p=0.003$ ; Fig. 1). Male mid-exercise  $T_{\text{C}}$  was greater than their baseline and female mid-exercise for the S condition while for the NS condition male mid-exercise  $T_{\text{C}}$  was lower than their baseline ( $p=0.014$ ).



In the chamber,  $T_{\text{C}}$  increased with time ( $p<0.001$ ) with no suit or gender effects. HR in the field for S was greater than NS condition for males and opposite for females ( $p=0.034$ ) while in the chamber, HR only increased with exercise ( $p<0.001$ ). For  $T_{\text{SK}}$  in the chamber, differences for time with a gender interaction existed for head ( $p=0.006$ ), back ( $p=0.008$ ) and calf ( $p=0.001$ ) while differences for the effects of time existed for all sites in the field ( $p<0.001$ ). There was a main effect of time for skin blood flow for back, arm and calf with head and back also different for time with gender interaction in the field ( $p=0.022$ ) and chamber ( $p=0.039$ ) respectively. In the chamber, back skin blood flow was greater for the NS than S condition ( $p=0.031$ ). There were no differences identified for the effects of suit, time or gender for urine specific gravity or sweat loss.

Fig. 1: Core body temp. at baseline and mid-exercise testing for S and NS in the field when pooled for gender. <sup>a</sup>  $T_{\text{C}}$  at mid-exercise > baseline for S; <sup>b</sup>  $T_{\text{C}}$  for S > NS at mid-exercise; <sup>c</sup>  $T_{\text{C}}$  at mid-exercise < baseline for NS ( $p=0.003$ )

## Discussion/Conclusion

Under the assessed controlled conditions, junior surf lifesavers are not at an increased risk of developing heat-related illnesses whilst wearing Lycra stinger suits. However, interpretation of results should be treated with caution given that a number of children exceeded a  $T_{\text{C}}$  of  $38^{\circ}\text{C}$  under the relatively mild conditions of the field-testing sessions.

## References

1. Bar-Or, O. (1994). *Sports Sci Exchange*. 7(2).