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Myocardial functional responses do not contribute to maximal exercise performance in the heat

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Abstract

Background: Both the extent and means by which maximal oxygen uptake ($\dot{V}O_{2\max}$) is depressed by elevated ambient temperature are uncertain. Particularly, information is currently unavailable regarding the possible influence of alterations in myocardial function on $\dot{V}O_{2\max}$ and performance during exercise in the heat. This study investigated the effects of environmental heat on $\dot{V}O_{2\max}$, peak work capacity, and myocardial function during a standard, progressive cycle test to exhaustion. Twelve euhydrated men (aged 20.7 ± 1.7 years) performed a maximal cycle test in an environmental chamber in both heat stress [35°C , 30% relative humidity (RH)] and temperate (20°C , 30% RH) conditions with measurement of standard gas exchange variables, core temperature, and echocardiographic measures of cardiac function.

Results: A small but statistically significant reduction of peak work capacity was observed in the heat stress versus temperate conditions (253 ± 30 and 259 ± 30 W, respectively, $p = 0.02$). Mean $\dot{V}O_{2\max}$ was not statistically different in the two conditions ($p = 0.16$) but values were 3.4% lower in the heat, and 9 of 12 participants demonstrated lower values in the heat stress trial. No differences in responses of heart rate, cardiac output, stroke volume, core temperature, hydration status, or myocardial systolic or diastolic function were observed between the two conditions, but perceived body temperature was higher in the heat.

Conclusions: The small, negative impact of heat on exercise performance and $\dot{V}O_{2\max}$ could not be explained by disturbances in myocardial functional responses to exercise in young adult males.

Keywords: Heat stress, Maximal exercise, Cardiac function