

COMPARISON OF PHYSIOLOGIC AND PERCEPTION BASED INDICES OF HEAT STRAIN

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The physiological strain index (PSI) has recently been introduced as a universally-applicable measure of the strain induced by exercise-heat stress. PSI (on a scale of 0 to 10) gives equal weight to normalized increases in deep body temperature (T_c) and heart rate. However, PSI has not been compared to an index modelled by the perception of these physiological changes. Following the same mathematical recipe as the PSI, the perceptions of thermal sensation and perceived exertion were combined and the resultant index, PeSI, was then compared to its physiological counterpart. Twenty males and six females participated in an exercise-heat stress experiment for this purpose. Subjects were grouped according to their level of aerobic fitness [athletically trained (T) and untrained (U)]. U subjects ($n = 13$) had a higher level of body fatness (mean \pm SD 18.1 ± 5.3 vs. $12.6 \pm 4.5\%$; $p < 0.010$) and a lower level of aerobic fitness ($VO_{2max} = 43.6 \pm 3.8$ vs. 59.0 ± 6.2 mL \cdot min $^{-1}\cdot$ kg $^{-1}$; $p < 0.001$). While wearing semi-impermeable clothing, subjects walked (3.5 km \cdot h $^{-1}$) under hot conditions (40°C and 30% RH) until exhaustion or when their T_c reached 39.5°C . There was no group difference in PSI, yet T perceived their physiological strain lower than U ($p < 0.002$) during the first 60 min of exposure. There was also no difference between the indices for U whereas PSI was higher than PeSI for T ($p < 0.008$). By the end of the exposure (69.2 ± 11.5 vs. 94.6 ± 17.7 min for U and T, respectively; $p < 0.001$), T had a higher value of PSI (8.23 ± 0.72 vs. 6.74 ± 1.47 ; $p < 0.002$) but there was no group difference in PeSI. While the indices were not different for U, PSI was higher at the end than PeSI for T (6.14 ± 1.68 ; $p < 0.001$). Thus, T underestimated their PSI throughout the exposure whereas U consistently perceived their physiological strain in accordance with the measured increases in core temperature and heart rate.

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