Running mechanical alterations during repeated treadmill sprints in hot versus hypoxic environments. A pilot study.

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Abstract

We determined if performance and mechanical running alterations during repeated treadmill sprinting differ between severely hot and hypoxic environments. Six male recreational sportsmen (team- and racket-sport background) performed five 5-s sprints with 25-s recovery on an instrumented treadmill, allowing the continuous (step-by-step) measurement of running kinetics/kinematics and spring-mass characteristics. These were randomly conducted in control (CON; 25°C/45% RH, inspired fraction of oxygen = 20.9%), hot (HOT; 38°C/21% RH, inspired fraction of oxygen = 20.9%; end-exercise core temperature: ~38.6°C) and normobaric hypoxic (HYP, 25°C/45% RH, inspired fraction of oxygen = 13.3%/simulated altitude of ~3600 m; end-exercise pulse oxygen saturation: ~84%) environments. Running distance was lower ($P < 0.05$) in HOT compared to CON and HYP for the first sprint but larger ($P < 0.05$) sprint decrement score occurred in HYP versus HOT and CON. Compared to CON, the cumulated distance covered over the five sprints was lower ($P < 0.01$) in HYP but not in HOT. Irrespective of the environmental condition, significant changes occurred from the first to the fifth sprint repetitions (all three conditions compounded) in selected running kinetics (mean horizontal forces, $P < 0.01$) or kinematics (contact and swing times, both $P < 0.001$; step frequency, $P < 0.001$) and spring-mass characteristics (vertical stiffness, $P < 0.001$; leg stiffness, $P < 0.01$). No significant interaction between sprint number and condition was found for any mechanical data. Preliminary evidence indicates that repeated-sprint ability is more impaired in hypoxia than in a hot environment, when compared to a control condition. However, as sprints are repeated, mechanical alterations appear not to be exacerbated in severe (heat, hypoxia) environmental conditions.

KEYWORDS:

Heat; hypoxia; repeated-sprint ability; sprinting mechanics