

Sleep Duration is Increased Following Muscle Damaging Exercise in Hot Environmental Conditions

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Category: Doctoral

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ABSTRACT

Sleep and recovery measures are typically negatively affected by a muscle-damaging bout of exercise. However, it remains unknown if the additive effects of hot environmental conditions, resulting in increased core temperature and other thermoregulatory responses during the exercise bout, further progress changes in quantity and performance quality of sleep duration. **PURPOSE:** To investigate the effect of muscle-damaging exercise in the heat, compared to a thermoneutral condition, on sleep and recovery measures. **METHODS:** Ten healthy males (age: 23 ± 3 yr; body mass: 78.7 ± 11.5 kg; height: 176.9 ± 5 cm; lactate threshold [LT]: 9.7 ± 1.0 km·hr⁻¹) performed two protocols in a randomized, counterbalanced order of downhill running (DHR) for 30-minutes at the LT in either a thermoneutral (ambient temperature [T_{amb}], 20°C; relative humidity [RH], 20%) or hot environmental condition (T_{amb}, 35°C; RH, 40%) at a -10% gradient. Sleep and recovery measures were collected from a wearable sleep device participants wore the night after the DHR. Differences in sleep and recovery measures following DHR in the heat compared to a thermoneutral condition were analyzed using paired samples T-tests. **RESULTS:** Sleep hours, restorative sleep hours, rapid eye movement (REM) sleep hours, and slow wave sleep (SWS) hours were all greater following the heat condition (mean \pm SD; sleep hours: 6.70 ± 0.74 hr, $p = 0.040$; restorative sleep hours: 3.31 ± 0.90 hr, $p = 0.012$; REM sleep hours: 1.70 ± 0.64 hr, $p = 0.046$; SWS hours: 1.61 ± 0.35 hr, $p = 0.015$) compared to the thermoneutral condition (sleep hours: 5.24 ± 1.75 hr; restorative sleep hours: 2.45 ± 1.11 hr; REM sleep hours: 1.23 ± 0.68 hr; SWS: 1.22 ± 0.53 hr). Also, recovery was higher following the heat condition (recovery: 75.88 ± 15.31 , $p = 0.023$) compared to the thermoneutral condition (recovery: 50.75 ± 21.46). Sleep efficiency, sleep disturbance, sleep deprivation, sleep score, %REM, %SWS, light sleep, resting heart rate, and heart rate variability were not different between conditions ($ps > 0.05$). **CONCLUSION:** Following muscle-damaging exercise in the heat, sleep and recovery duration measures were increased compared to a thermoneutral condition. These findings suggest that performing muscle-damaging exercises in hot conditions may require a greater amount of sleep for optimal recovery.