# THE EFFECT OF SLEEP DEPRIVATION UNDER BRIGHT LIGHT CONDITION ON THERMOREGULATORY RESPONSES TO HYPERTHERMIA

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It is well recognized that the circadian rhythm of resting internal temperature in humans shows a nadir in the early morning and a peak in the evening. Similarly, effector responses to thermoregulatory challenges show a circadian rhythm. For example, during heat stress (passive heat stress or dynamic exercise), internal temperature thresholds for thermoregulatory sweating and skin blood flow controls are subject to a circadian rhythm. Compared to dim light exposure, bright light exposure during sleep deprivation in the night leads to suppressed secretion of melatonin and attenuates the decline in internal temperature in the early morning. However, it is unknown whether thermoregulatory sweating and skin blood flow responses in the early morning are changed by the difference of internal temperature levels associated with light conditions during sleep deprivation. We investigated the effect of sleep deprivation under different light conditions on thermoregulatory responses to hyperthermia in the early morning. Six male subjects rested in a semi-supine position underwent nights of sleep deprivation in bright (2800 lux) light or dim (120 lux) light between 2100 hours and 0430 hours. Two experiments were performed in random order, and at least 1 week elapsed between experiments. After each sleep deprivation, passive heat stress was performed by immersing the legs below the knee in hot water (42°C) for 50 minutes from 0530 hours. Sweating rate (SR) and skin blood flow (SkBF) were monitored on the chest and forearm. After hot water immersion, maximal cutaneous vascular conductance (CVC) was measured by locally warming the sites of SkBF measurement to 42°C for 40 minutes. Urine levels of 6-sulfatoxymelatonin during sleep deprivation were lower under bright light exposure than that in dim light exposure. On the other hand, during sleep deprivation, rectal temperatures were maintained significantly higher in bright light condition compared with that in dim light condition. Similarly, before the hot water immersion, the esophageal temperature (Tes) measured during passive heat stress was significantly higher in bright light than in dim light condition. The time courses of SR and %CVC, expressed as a percentage of maximal CVC, were not statistically different between light conditions. The Tes thresholds for onset of sweating and cutaneous vasodilation were significantly higher in bright light than in dim light condition. However, each sensitivity of effector responses (the slope of %CVC or SR with respect to Tes) was not significantly altered between light conditions. These findings indicate that thermoregulatory sweating and skin blood flow responses to hyperthermia in the early morning are shifted by the attenuation of decreasing internal temperature levels during sleep deprivation with bright light exposure.

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