White Light's Effect on Melatonin in Adolescents and Older Adults

Melatonin, a hormone produced at night and in darkness, is a timing messenger for the body. In animal models, melatonin has also been shown to reduce the growth rate of tumors. Previous studies suggest that adolescents are more sensitive to light at night (LAN) for melatonin suppression.

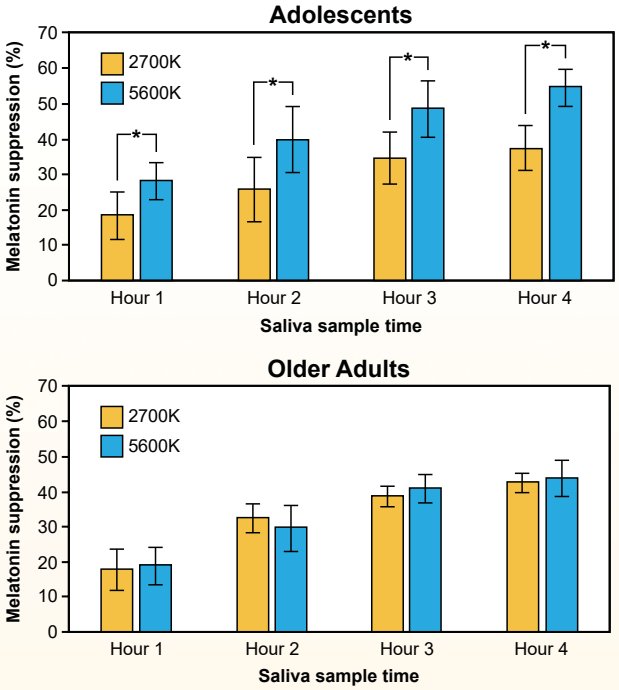
Since exposure to LAN has been implicated as an endocrine disruptor, it is important to understand the dose (i.e., amount and duration) of light that is required to suppress melatonin. The primary purpose of this study was to determine how the amount and duration of LAN exposure suppresses melatonin in two contrasting age groups.

Twelve adolescents (aged 13–18, mean = 16.3 yr) and 12 older adults (aged 32–51, mean = 47.3 yr) experienced three lighting conditions: (1) dim light, (2) a 2700K source delivering circadian stimulus (CS) = 0.25, and (3) a 5600K source delivering CS = 0.25. Light was delivered from overhead luminaires. (Circadian stimulus is a measure of the effectiveness of retinal light exposure for the human circadian system.)

Upon arrival in the lab at 10:30 p.m., participants remained in dim light (< 5 lx at the cornea) for 30 min, immediately followed by the collection of a saliva sample. At 11:00 p.m., participants experienced the evening's lighting condition for 4 hr and saliva samples were collected every hour thereafter until the final sample was taken at 3:00 am.

Results

- Adolescents are more sensitive to light sources that have higher short-wavelength content.
- After the initial 1-hr test interval, the duration of exposure affects adolescents more than older adults.
- Melatonin suppression rates appear to decrease for exposures longer than 3 hr, especially for older adults.



These graphs show melatonin suppression with respect to the dim light condition (y-axis) calculated from saliva samples taken over the 4-hr data collection period (x-axis) for adolescents and older adults when exposed to both experimental light sources (2700K and 5600K). The lighting was calibrated to provide equal CS of 0.25. As can be observed from these graphs, even though melatonin suppression for older adults was similar for both sources, it was consistently higher for adolescents when exposed to the 5600K source compared to the 2700K source. (Asterisks represent statistical significance, $p < 0.05$.)

Implications for Practice

Adolescents' higher sensitivity to short-wavelength light should be considered when developing lighting designs for schools and other youth facilities, particularly those that hold nighttime activities. This should also be a consideration for the use of self-luminous electronic displays in the evening.

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