Impact of 470-nm (Blue) Light on Acute Melatonin Suppression

The spectral sensitivity of the human circadian system peaks near 450 nm. The goals of this study were to investigate the impact of various 470-nm light doses (quantity and duration) on acute melatonin suppression and the threshold for acute melatonin suppression by 470-nm light.

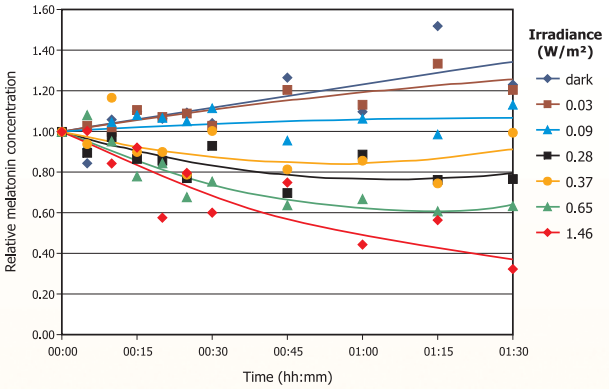
Experiment

LRC researchers tested one dark control condition and six irradiances of 470-nm light. Nine subjects over 50 years old participated in a within-subjects protocol over the course of seven sessions. After one hour in dim 630-nm (red) light, subjects were exposed to 470-nm light for 90 minutes. Blood and saliva samples were collected at regular intervals for melatonin assay.

Subject wearing the 470-nm light goggles used in the experiment.

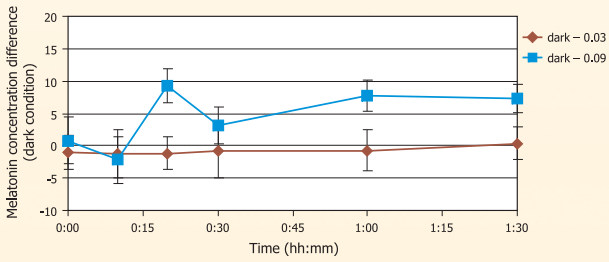
Results

The figure (above, right) shows the normalized melatonin concentrations for each lighting condition. Melatonin levels continue to rise in the dark. Relative to the control night, melatonin levels were significantly lower after 60-minute exposure to most lighting conditions, except for 0.03 W/m² and 0.09 W/m².



Normalized plasma and saliva median concentrations set on a relative scale with best fit quadratic trend lines. Irradiances were adjusted by pupil factor (pupil diameter²/2.3²).

The figure below shows the difference between melatonin levels in the dark and after exposure to the two lowest irradiances. There is no significant difference between melatonin levels after exposure to 0.03 W/m² and after the dark condition at any time over the course of 90 minutes, suggesting that the threshold for acute melatonin suppression by 470-nm light is between 0.03 W/m² and 0.09 W/m². Low levels of short-wavelength light can have the same impact on the circadian system as high levels of "white" light sources.



Sponsors

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