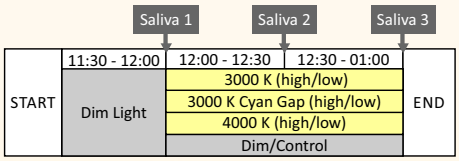
Effects of White Light on Melatonin Suppression

The LRC investigated the effects of spectrally distinct white light sources on nighttime melatonin suppression. Sixteen participants experienced two dim light conditions and six lighting conditions derived from permutation of three spectrally distinct white light sources at two light levels. Each participant wore a Daysimeter at eye level to measure the actual light exposures experienced under each experimental condition.

For nighttime experimental sessions, participants remained in the dark for 30 minutes, followed by one-hour exposure to one of the eight experimental conditions. Over the 90-minute period, three saliva samples were collected from each participant.



The protocol (above) was used for the nighttime experimental sessions.

Light Level	Stimulus	3000 K	3000 K Modified	4000 K
High	Photopic Illuminance (lux)	897 ± 96.8 SD	787 ± 119.4 SD	933 ± 111.7 SD
	CL_A*	790	482	532
	Melanopic lux**	436	265	633
Low	Photopic Illuminance (lux)	384 ± 50.3 SD	361 ± 34.1 SD	361 ± 115.3 SD
	CL_A*	338	221	187
	Melanopic lux**	187	122	236

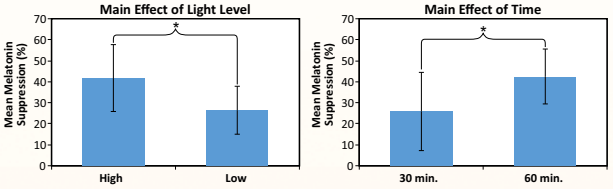
Mean light stimulus as measured from respective Daysimeters. Standard deviation (SD) is not available for CL_A (Rea et al. 2012*) and melanopic lux (Enezi et al. 2011), as these values have been essentially derived from the Daysimeter data for mean photopic illuminance.**

* Rea MS, Figueiro MG, Bierman A, Hamner R. 2012. Modelling the spectral sensitivity of the human circadian system. *Light Res Technol.* **44:**386-396.

** Enezi Ja, Revell V, Brown T, Wynne J, Schlangen L and Lucas R. 2011. A "melanopic" spectral efficiency function predicts the sensitivity of melanopsin photoreceptors to polychromatic lights. *J Biol Rhythms*. **26:** 314-23.

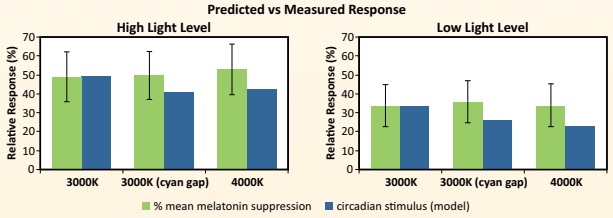
Results

Statistical analyses, performed using repeated measures analysis of variance (ANOVA), revealed significant main effect of time ($F_{1,9}$ = 41.996, $p < 0.05$), and light level ($F_{1,9}$ = 13.704, $p < 0.05$), on nighttime melatonin suppression. Statistical analysis did not reveal a significant main effect of light source spectrum, wherein the mean melatonin suppression across the three spectra was not statistically discernible.



Implications for practice

- Correlated color temperature alone is not an accurate metric to predict circadian effectiveness of a light source
- Longer exposure durations and higher light levels will result in higher melatonin suppression during the early part of the biological night
- A light source that does not stimulate the ipRGCs (lower radiant energy at 484 nm) does not necessarily translate to less melatonin suppression



Mean ± SEM melatonin suppression for the two light levels after 1-hour exposure, normalized to the control (dim) light, as compared to the *a priori* predictions (circadian stimulus, CS) derived using the Rea et al. 2012 model

Sponsors

Light and Health Alliance (Acuity Brands, Cree, Current by GE, Ketra, OSRAM, Philips, USAI Lighting), Lumileds

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