Red Light Improves Nighttime Alertness and Performance

Rotating shift workers, particularly those working at night, are likely to experience sleepiness, decreased productivity, and impaired safety while on the job. Light at night has been shown to have acute alerting effects, reduce sleepiness and improve performance, although it may also induce circadian disruption, which has been linked to increased health risks. Previous studies showed that long-wavelength (red) light exposure increases objective and subjective measures of alertness at night without suppressing nocturnal melatonin and inducing circadian disruption.

The present study investigated whether exposure to red light at night would increase measures of alertness and improve performance. LRC researchers hypothesized that exposure to red and white light would improve performance, and that only white light would significantly affect nighttime melatonin levels.

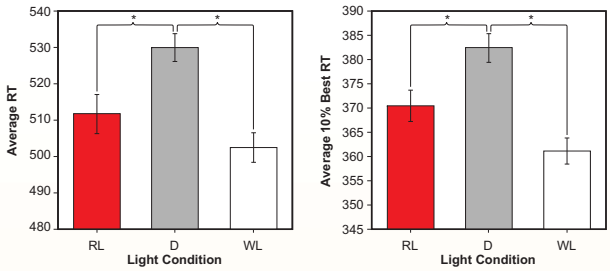
Seventeen individuals participated in a three-week, within-subjects, nighttime laboratory study. The three lighting conditions were dim light, red light (λmax = 631 ± 1 nm, full width half maximum 16 ± 1 nm), and white light (correlated color temperature of 2568 ± 22 K). Clear safety goggles were fitted with four white light-emitting diodes (LEDs) or four red LEDs to deliver the prescribed dose of light at the cornea.

Sponsor

Office of Naval Research (# N00014-11-1-0572)

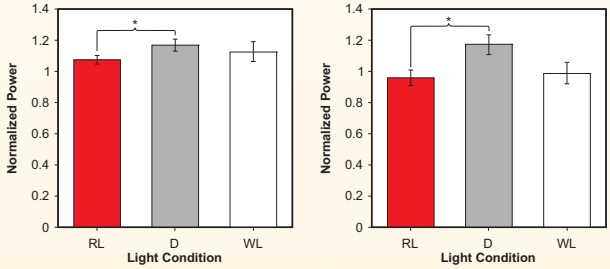
Publication

Figueiro MG, Sahin L, Wood B, Plitnick B. 2014. Light at night and measures of alertness and performance: Implications for shift workers. *Biological Research for Nursing*. In press.



Mean ± SEM of the reaction time (RT; left) and the 10% best RT (right) for each lighting condition: red light (RL), dim light (D) and white light (WL). Participants' RT and 10% best RT were significantly greater (* = statistically significant) after D than after RL and WL conditions, suggesting that participants were reacting faster after light exposure.

The results showed that, compared to remaining in dim light, participants had significantly faster reaction times after exposure to both white and red light at night. Compared to dim light, objective alertness (reduction in power in the alpha and alpha-theta regions) was significantly increased after exposure to red light. Melatonin levels were significantly suppressed by white light only.



Mean ± SEM normalized alpha-theta (5–9 Hz) (left) and alpha power (8–12Hz) (right) for each lighting condition: red light (RL), dim light (D) and white light (WL). Power in alpha and alpha-theta ranges were significantly lower (* = statistically significant) after exposure to RL than after exposure to D.

These results showed that not only can red light improve measures of alertness, but it can also improve certain types of performance at night without affecting melatonin levels. The findings could have significant practical applications; red light could be used to maintain alertness in shift workers without affecting their circadian phase.

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