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ABSTRACTS

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Prolonged Photoperiod Induces Changes in Sleep: The Impact of Blue-Enriched Light

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Objectives: Light exerts a direct effect on slow-wave sleep (SWS) and electroencephalogram (EEG) slow-wave activity (SWA; 0.5–4 Hz). It has been suggested that blue-enriched light promotes alertness in both humans and rodents through signaling via intrinsic photosensitive retinal ganglion cells (ipRGCs). Here we use a model of prolonged photoperiod (20 h light, 4 h dark; 20:4 LD) of two different light spectra (white and blue-enriched) to characterize the effects on sleep in rats.

Methods: Rats (n = 6/group) were housed in 12:12 LD cycle for 5 days, followed by 7 days of exposure to prolonged photoperiod 20:4 LD in either white or blue-enriched light, and 7 days recovery in 12:12 LD. Sleep (EEG and electromyogram) was recorded continuously by means of telemetry. We report data (% ± SEM change from 24 h baseline) and statistical analyses on total sleep time (TST), time in SWS, and SWA from day 7 of exposure to prolonged photoperiod (E7), and recovery day 1–7 (R1–R7).

Results: At E7, only white light increased TST (white: 8.9 ± 3.6%, p = 0.004 vs. blue: 3.6 ± 1.5%, p = 0.155) and time in SWS (white: 8.9 ± 3.7%, p = 0.014 vs. blue: 4.1 ± 1.7%, p = 0.193). SWA in SWS was not significantly changed at E7 compared to baseline. During recovery in the 12:12 LD condition, TST was increased at R2 (prolonged white: 8.3 ± 3.4%, p = 0.023), R3 (prolonged blue: 8.3 ± 3.4%, p = 0.030) and R4 (prolonged blue: 7.5 ± 3.1%, p = 0.042) compared to baseline. Time in SWS and SWA in SWS showed no significant differences at R1-R7 compared to baseline.

Conclusions: Prolonged photoperiod has short and long-term effects on sleep in the rat, and the effects are dependent upon light spectra. Prolonged exposure to white light increased total sleep time and time spent in slow-wave sleep, whereas prolonged exposure to blue-enriched light increased total sleep time in recovery only.

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The Effect of Bright Light on Blood Pressure and Heart Rate in Essential Hypertension

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Objectives: Bright light therapy (BLT) showed positive results with respect to seasonal affective disorders, non-seasonal depression, sleep disorders and so on. Meanwhile, there is still little data concerning the effects of light therapy on functional activity of the cardiovascular system and particularly in case of hypertension. We therefore studied the features of daytime and nighttime blood pressure (BP) and heart rate (HR) in genetically hypertensive and normotensive rats under the action of bright light (BL).

Methods: We performed our experiments on 32–34 weeks old male rats of SHR (hypertensive, n = 5) and Wistar-Kyoto (normotensive, n = 5) strains. Animals were kept in individual cages under 12:12 h light-dark schedule with light on at 7.00 am and off at 7.00 pm, daytime ~ 300 lux white light at eye level and nighttime absolute darkness. To estimate the effect of BL the animals were exposed to 1 hour action of ~ 10,000 lux white LED light from 10.00 am to 11.00 am. Systolic and diastolic blood pressure (SBP and DBP), heart rate (HR) were monitored continuously for 24 hours the day before (controls) and on the very day of BL exposure. BP and HR monitoring was carried out with the use of radio-telemetry system (DSI, USA) which consists of radio-transmitter (sensor) DSI HD-S11 implanted in the animal body, receiver, data exchange matrix and computer for storing data. BP was monitored in the lumen of the abdominal aorta. Thanks to the use of implantable sensors animals were totally freely moving the whole duration of the experiment. The data was processed with software Dataquest A.R.T. 4.33 (DSI, USA).

Results: It was found that SBP and DBP were significantly higher in the SHR rats compared to the normotensive rats for the whole 1 hour period of BL exposure in comparison with the same time interval (from 10.00 to 11.00 am) of the previous day when BL was not used. The average levels of daytime (10.00 am – 7.00 pm) SBP and DBP were significantly increased in the hypertensive rats compared with the control rats which might indicate that the effect of BL remains notable even after the end of its exposure. For HR only a clearly defined tendency to an increase was seen. For the nighttime period after the day of BL exposure all of the monitored parameters of the hypertensive rats had the same values as in the controls. In normotensive rats the action of BL induced no significant changes in BP or HR.

Conclusions: Our data shows that BL induces an increase in BP in hypertensive but not in normotensive rats both at the time of BL exposure and after it. This should be taken into account when using BLT in case of concomitant hypertension.

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