

# Acute positive, but delayed, negative subjective non-image forming effects of morning bright light exposure in healthy day-active students

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**ACUTE POSITIVE, BUT DELAYED, NEGATIVE SUBJECTIVE NON-IMAGE FORMING EFFECTS  
OF MORNING BRIGHT LIGHT EXPOSURE IN HEALTHY DAY-ACTIVE STUDENTS**

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**Objectives**

Recent studies revealed acute activating effects of bright light exposure (BLE) on subjective feelings of alertness during daytime among healthy, non-sleep deprived participants. However, subjective aftereffects of BLE are largely unknown. The current study tested acute non-image forming (NIF) effects of morning and afternoon bright vs. normal light exposure on subjective alertness, vitality, tension and mood in healthy day-active students, but also explored delayed effects on these indicators as well as subjective sleep quality during the subsequent night.

**Methods**

This study employed a counterbalanced design with Light intensity (165 vs. 1700 lux at eye level, 60-minute exposure) manipulated within and Local clock time (morning vs. afternoon) between subjects. Thirty-four participants (15 male,  $M_{age} = 20.59$ ;  $SE_{age} = 0.38$ ) came to the lab on two separate occasions at the same time of the day (either 9 AM - 10:30 AM or 3:45 PM - 5:15 PM). Questionnaires on state subjective alertness, vitality, tension and mood were completed after the baseline phase (120 lux at eye level) and after the lighting condition. Each laboratory session was combined with an Experience Sampling Method (ESM) to probe participants' level of alertness, vitality, mood and tension at fixed moments during the remainder of their day. The morning after each laboratory visit, participants reported on their sleep timing and quality via a sleep diary questionnaire. Multilevel analyses, corrected for participants' chronotypes and multiple testing (Bonferroni), were conducted for each outcome measure.

**Results**

Results on the acute NIF effects of light intensity in the laboratory revealed significant Light\*Time of day interactions for subjective alertness ( $F(1,34) = 11.06$ ,  $p = 0.002$ ) and vitality ( $F(1,33) = 8.85$ ,  $p = 0.005$ ), indicating that participants felt more alert ( $p < 0.001$ ) and vital ( $p = 0.001$ ) after 1-hour 1700 vs. 165 lux exposure in the morning. ESM data revealed continued increased vitality up to 30 minutes after morning BLE ( $p = 0.02$ ), yet these vitalizing effects dissipated quickly afterwards. ESM data further showed significantly more tension at the end of the day (5:30 PM - 10:00 PM,  $p = 0.007$ ) after morning BLE. Sleep diary data suggested that participants reported to have slept significantly less calm ( $p = 0.009$ ) and reported to be significantly less happy the next morning after morning 1700 lux vs. 165 lux exposure ( $p = 0.01$ ). No acute or delayed differences on subjective indicators were found for afternoon BLE.

**Conclusions**

Although healthy day-active young people may experience acute vitalizing effects from morning BLE, they may experience negative effects in terms of tension later that day and decreased sleep quality during the subsequent night. This calls for more attention towards such aftereffects.

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None.