Blue light affects emotional processing in the hypothalamus in seasonal affective disorder

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Light therapy is an effective treatment for seasonal affective disorder (SAD). Using functional magnetic resonance imaging (fMRI), we have recently demonstrated that blue light affects emotional brain processing in healthy individuals, involving melanopsin-based photoreception. However, the impact of light through melanopsin-based photoreception on emotional brain processing in SAD remains unknown.

OBJECTIVES
In this study we assessed the impact of light exposure on brain responses to an auditory emotional task in SAD patients and control participants. Blue and green light exposures were compared to investigate the role of melanopsin-based photoreception in SAD.

METHODS
Fourteen SAD patients (9F; mean age: 34.5; range: 22-45) and 16 healthy controls (11F; mean age: 32; range: 21-44) performed a gender classification task on emotional voices (angry or neutral prosody) in fMRI while being alternatively exposed to 40s of blue (480nm) and green (550nm) monochromatic light. Irradiance levels of the blue and green illuminations were respectively set at $1.1x10^{13}$ photons/cm^2/s and $0.8x10^{13}$ ph/cm^2/s. Orders of the wavelengths were counter-balanced. The experiment took place 3.5h after habitual wake time between the 9th of November 2008 and the 6th of February 2009.

RESULTS

Compared with healthy controls, SAD patients presented an increased response to both auditory stimulus types (neutral and emotional) in the thalamus, irrespective of the light conditions (blue, green). In addition, compared with healthy controls, SAD patients showed a specific pattern of response to emotional auditory stimuli with an increased activation of the hypothalamus under blue light exposure and a decreased activation in the same hypothalamic region under green light exposure.

CONCLUSION

These results constitute the first demonstration of an acute influence of light, and the importance of its spectral quality, on emotional processing in a clinical population. Our findings support the involvement of melanopsin-based photoreception.

Supports: IRSC/CHRI.

Key terms (5): SAD - fMRI – light– melanopsin – hypothalamus – emotion