



It hurts me too: An fMRI study on the effects of experimental sleep restriction on empathy for pain in younger and older adults

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Background and aims

Emotional processes rely on adequate sleep and change with aging. Whether this is likewise true for social emotions, such as empathy, is not known. This study aims to investigate how neural and behavioral responses to pain in others are affected by sleep restriction and age, and whether age modulates the role of sleep in emotional functioning.

Method

In a randomized cross-over experimental design, 47 healthy young (age: 20-30) and 39 older (age: 65-75) volunteers underwent fMRI twice, after either normal sleep or sleep restricted to 3 hours. During the fMRI task, participants viewed pictures of needles pricking a hand (pain condition) or Q-tips touching a hand (control condition), and reported their vicarious unpleasantness (*fig 1*).

Figure 1. fMRI task

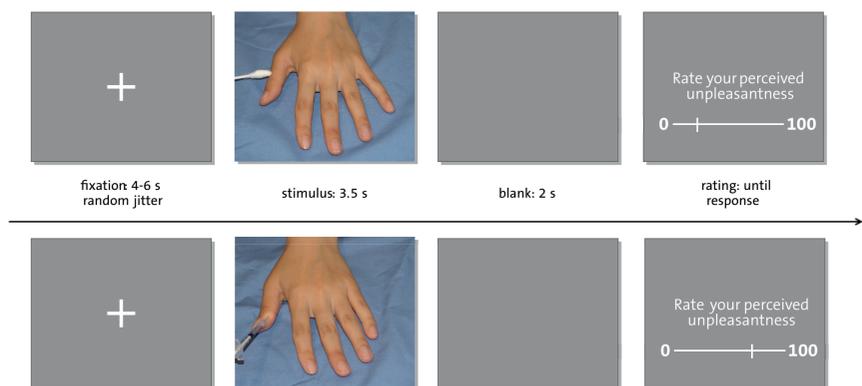
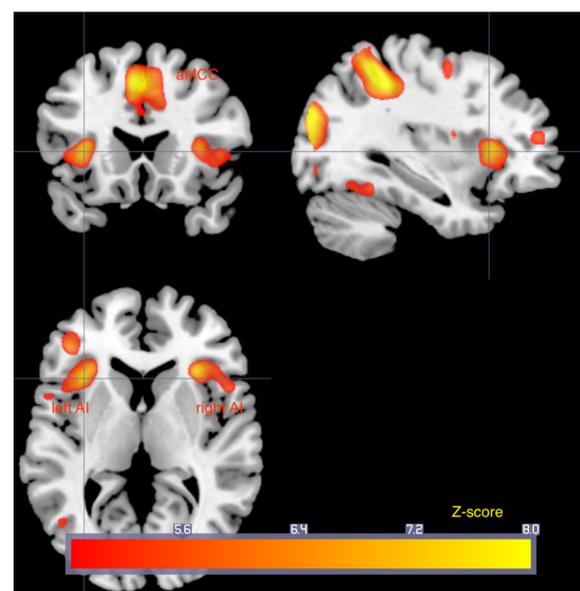


Figure 2.

Pain > no pain across all subjects and sleep conditions, thresholded at $p < 0.05$ FWE.



Results

Watching pictures of painful situations (or the pain condition) robustly activated anterior insula and anterior midcingulate cortex (*fig 2*). Older participants generally experienced more unpleasantness in response to pictures of pain compared to younger participants and this was accompanied by higher activity in angular gyrus (*fig 3*). Age and sleep interacted so that sleep restriction caused decreased unpleasantness in young and increased unpleasantness in old to pain stimuli, even though there was no significant simple main effect of sleep restriction in any age group. Given that empathy is crucial in effective interaction with others, our findings imply possible age-related changes in prosocial behavior. These differences were reinforced after sleep restriction (*fig 4*).

Figure 3.

Older > younger [pain > no pain], thresholded at 0.001 uncorrected.

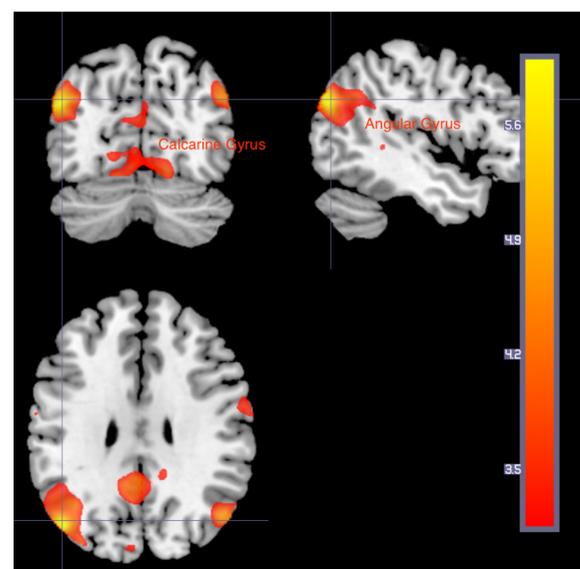
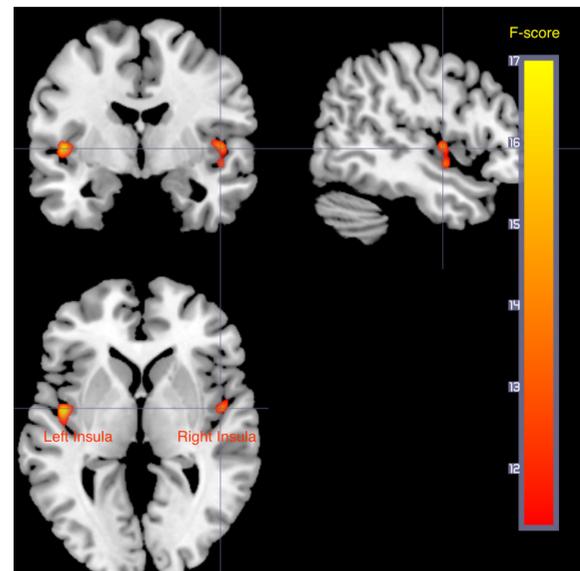


Figure 4.

Sleep x age interaction [pain > baseline], thresholded at 0.001 uncorrected.



Conclusions

Older participants generally responded more to pain in others compared to young. With sleep restriction, empathic responses in young and old changed in opposite directions. Given that empathy is crucial in effective interaction with others, our findings imply possible age-related changes in prosocial behavior, amplified with short sleep.