Comparing GABA Measures in Healthy Controls vs MCI Patients

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Background

- Age-related neural dedifferentiation refers to the finding that neural activation patterns in response to different stimuli are less distinctive in older vs. younger adults (Baltes & Lindenberger, 1997).
- This phenomenon largely contributes to age-related cognitive decline.
- Previous studies are largely restricted to studying healthy aging. The MiND study aims to address this by studying participants with mild cognitive impairment (MCI).
- By comparing healthy and MCI participants, we aim to understand how GABA, the brain's major inhibitory neurotransmitter, affects dedifferentiation.
- Specifically, how do declines in GABA and neural dedifferentiation relate to mild cognitive impairment?

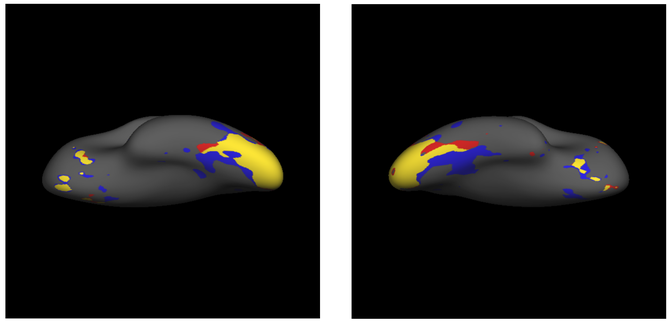

Figure 1: Activation patterns in left and right hemispheres of a participant during a visual task. Red regions were activated only in the face condition, blue regions were activated only in the house condition, yellow regions were activated in both conditions, and gray regions were activated in neither condition.

Methods

- 40 MCI participants and 244 healthy participants were recruited as part of the MiND study.
- Functional MRI data was collected while participants underwent auditory, visual, motor, and memory tasks. The most active region during each individual task was identified, and in these regions, two voxels were placed in either hemisphere before participants underwent an MRS scan. Memory had only one voxel placed.
- To calculate GABA levels from MRS data, we utilized the Gannet mATLAB toolbox, an open-source software for analyzing edited single-voxel MRS data.

Results

- MCI participants had significantly lower GABA concentrations in all voxels except for memory.

Voxel	F value	p value
Auditory	11.342	9.17e-4
Left Auditory	9.192	2.77e-3
Right Auditory	6.985	8.91e-3
Sensorimotor	17.505	4.38e-5
Left Sensorimotor	9.651	2.18e-3
Right Sensorimotor	18.433	2.81e-5
Ventrovisual	18.608	2.58e-5
Left Ventrovisual	11.121	1.03e-3
Right Ventrovisual	13.887	2.56e-4
Memory	0.170	6.81e-1

Table 1: ANOVA results for alpha tissue corrected data for MCI vs. Healthy participants. Significant p-values are highlighted in red.

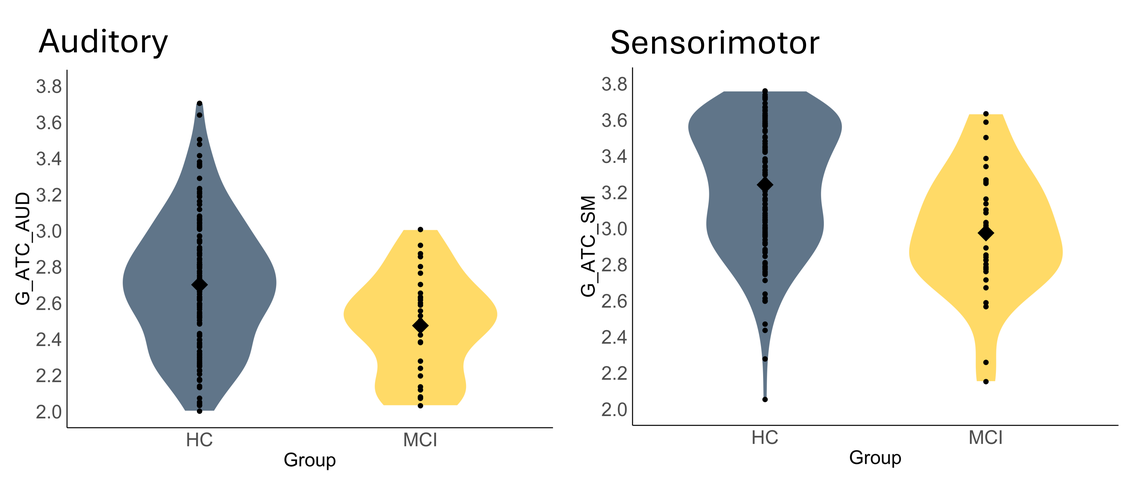

Figure 2: Violin plots showing GABA levels in each voxel. Mean values are shown with black diamonds.

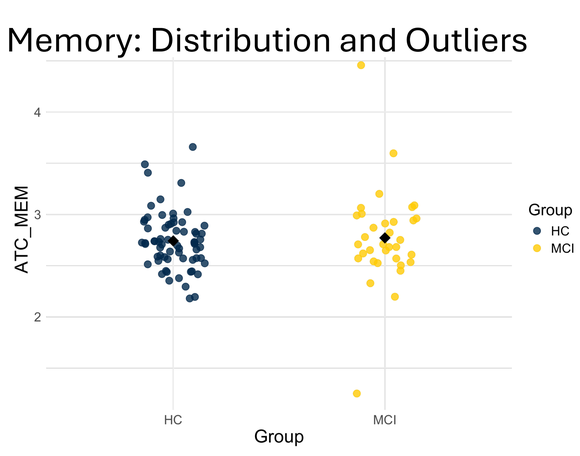

Figure 3: Scatterplot showing GABA levels in memory voxel.

Conclusions

- GABA is consistently lower in MCI than healthy controls.
- Future work should further study how GABA levels differ in brain regions associated with memory in MCI vs. healthy older adults.

References

Baltes, P. B., & Lindenberger, U. (1997). Emergence of a powerful connection between sensory and cognitive functions across the adult life span: A new window to the study of cognitive aging? *Psychology and Aging*, *12*(1), 12–21. https://doi.org/10.1037/0882-7974.12.1.12