Associations between markers of Neurodegeneration and Cognition in the Oldest-Old Individuals from Colombia

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Background

- Life expectancy is rising, accompanied by an increased prevalence of cognitive impairment and Alzheimer's disease (AD). Age is currently the biggest risk factor for AD.
- Half of individuals aged ≥80, known as the oldest-old, maintain normal cognition despite significant AD pathology (Lopez, 2018; Mathis, 2013)
- A recent study in Southern Colombia found that over 50% of individuals aged ≥50 have MCI, one of the highest rates in Latin America (Bonilla-Santos, 2023).
- Our group presented normative neuropsychological data for Colombians over 80, offering a unique chance to study cognitive preservation in the oldest-old from the Antioquian region.

Study aims

- Examine the relationship between neurodegeneration and cognitive performance in oldest-old individuals from the Antioquia region of Colombia.
- Compare these measures with a control group of younger individuals with minimal cognitive impairments.

Methods

- **Participants:** Oldest-Old: 112 participants (≥80 years) recruited by the Neurociencias group at Universidad de Antioquia, Medellín, Colombia. Only 13 participants (mean age = 93.62, SD = 5.85) completed neuroimaging. Minimal subjective cognitive and functional complaints at enrollment. Control: 52 Spanish-speaking participants from the Boston Latino Aging Study (BLAST) (mean age = 65.06, SD = 6.58).
- **Procedures:**
  - Neural integrity measured by MRI and PET scans at Hospital Pablo Tobón Uribe Medellín, Colombia (Oldest-old) and Massachusetts General Hospital, Boston, MA (Control).
  - MRI measures processed with FreeSurfer (V6.0.1). Left and right hippocampal volumes averaged.
  - Cognitive performance measured by Mini-Mental State Exam (MMSE) total scores.
  - Cognitive normativity: Total MMSE score < 15 for zero years of education, < 20 for 0.5–3 years, < 23 for 4–6 years, < 25 for 7–9 years, < 26 for 10+ years.
  - Functional impairment criteria met by 4 oldest-old subjects and 7 control subjects.
- **Statistical Analyses:** Spearman's correlations, adjusted for education, to investigate the relationship between neurodegeneration markers (MRI and FDG-PET) and cognitive performance (MMSE total scores) in the oldest-old. Mann-Whitney tests to compare markers of neurodegeneration and cognition in the oldest-old to controls. MATLAB (v9.11) and SPSS (v28).

	Cognitively Unimpaired		Cognitively Impaired	
	Oldest-old (n=9)	*Control (n=45)*	*Oldest-old (n=4)*	*Control (n=7)*
Age	92.4(6.19)	64.9(6.80)	96.3(4.64)	66.3(5.12)
Years of Education	5.44(5.41)	12.2(4.67)	3.25(3.95)	10.43(4.24)
MMSE Total	24.6(3.25)	27.9(1.16)	14.5(4.66)	22.3(3.45)
Animal Fluency	9.56(2.88)	17.2(4.51)	3.5(3.87)	12.71(5.09)

Table 1: Demographic Characteristics

Results

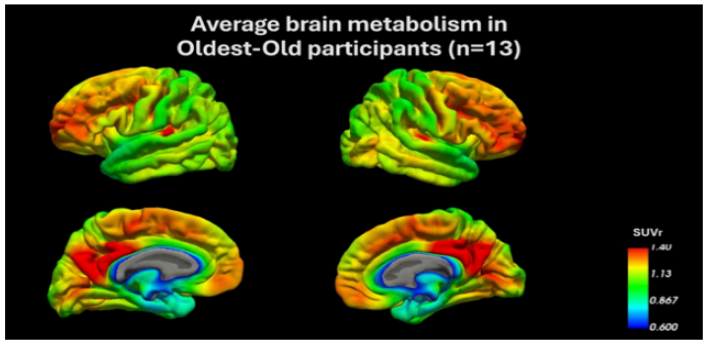

Figure 1: Average Brain Metabolism in Oldest-old Participants. Brain metabolism measures showed no correlation with cognitive measures

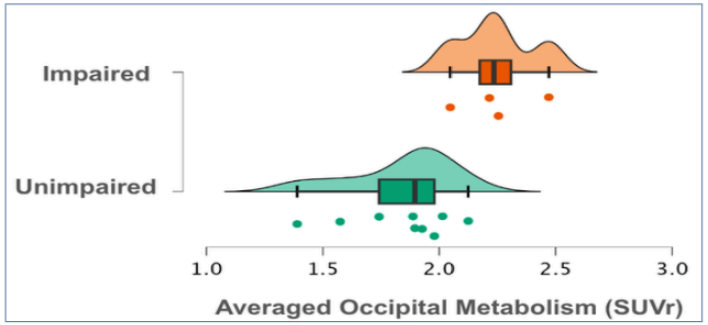

Figure 2: Differences in Markers of Neurodegeneration in Oldest-Old. There were significant differences in averaged occipital metabolism between cognitively-impaired and unimpaired oldest-old participants (p=0.006)

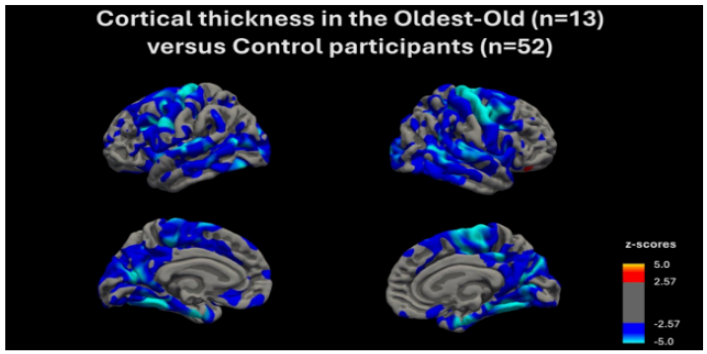

Figure 3: Oldest-Old Participants Show Significantly Less Cortical Thickness Compared to Controls.

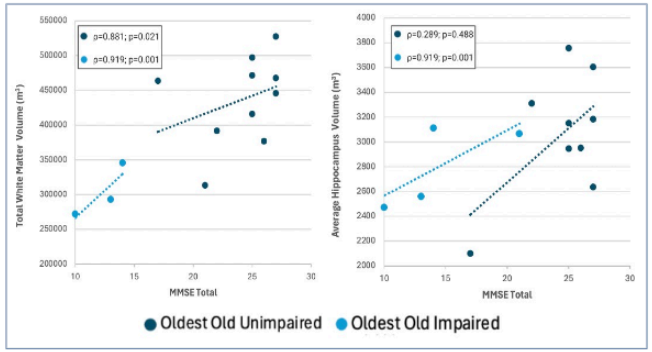

Figure 4: Associations Between Markers of Neurodegeneration and Cognitive Performance. Spearman Correlations, adjusted for education, were used.

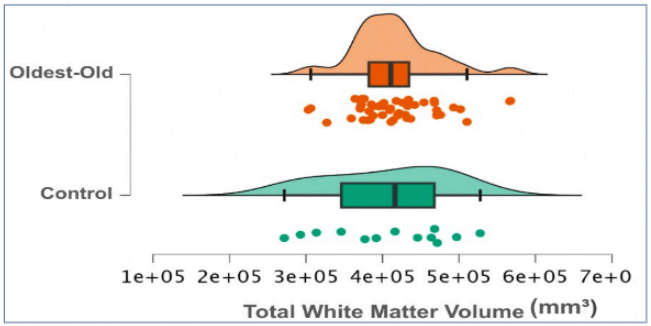

Figure 5: Differences in Markers of Neurodegeneration in Oldest-Old vs Controls. Although there were significant differences across all other measures of neurodegeneration, there was no significant difference in total white matter volume.

Discussion

- This is the first study to investigate neurodegeneration markers in the oldest-old from this region.
- A major limitation is the significant difference in education between the Oldest-Old and Controls, as education strongly correlates with MMSE performance and impacts brain reserve and neurodegeneration markers. Additionally, we did not have FDG data for our control group.
- Our results suggest that total white matter volume may be crucial for cognitive preservation. Future studies should use advanced neuroimaging techniques, include larger sample sizes, and incorporate genetic information to confirm these findings and further explore cognitive preservation.

Funding / References

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References