We used [18F]fluorodeoxyglucose (FDG) PET analysis to determine performance in different olfactory domains of patients with early AD compared to cognitively healthy subjects, and to map the functional metabolic representation of olfactory impairment in the patient sample. A cohort of patients with early AD (n=24), consisting of 6 subjects with incipient AD and 18 subjects with mild AD, and a control group of 28 age-matched non-demented individuals were assembled. Patients and controls were tested for olfactory performance using the "Sniffin' Sticks" test battery [odor identification (ID), discrimination (DIS) and threshold (THR)], while patients additionally underwent resting state FDG-PET. Voxel-wise PET results in the patients were correlated with olfaction scores using the general linear model in SPM5. Patients with early AD showed significantly reduced function in all three olfactory subdomains compared to controls. After controlling for effects due to patients' age, gender, cognitive status, and treating scores in the two other olfactory subdomains as nuisance variables, ID scores correlated with normalized FDG uptake in clusters with peaks in the right superior parietal lobule, fusiform gyrus, inferior frontal gyrus, and precuneus, while DIS scores correlated with a single cluster in the left postcentral cortex, and THR.
scores correlated with clusters in the right thalamus and cerebellum. The subtests employed in the "Sniffin' Sticks" test battery are complementary indicators of different aspects of olfactory dysfunction in early AD, and support the theory of a parallel organized olfactory system, revealed by FDG-PET correlation analysis.

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