

SUPPLEMENTARY INFORMATION

Association of Olfactory and Cognitive Function Test Scores with Hippocampal and Amygdalar Grey Matter Volume: A Cross-Sectional Study

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Supplementary Table S1. Multiple regressions without stratification for the left and right

hippocampi, left amygdala, and right parahippocampus, with the MoCA-J score as an

explanatory variable

ROI	Explanatory and adjusted variables	Standardised partial regression coefficient		
		Estimate	[95% CI]	<i>P</i> -value
Left hippocampus	Olfactory score	0.051	[0.008 , 0.094]	0.020
	MoCA-J score	0.049	[0.005 , 0.093]	0.029
	Age	-0.507	[-0.553 , -0.462]	<0.001
	Sex	-0.213	[-0.262 , -0.163]	<0.001
	Education duration	-0.077	[-0.118 , -0.037]	<0.001
	Smoking history	0.050	[0.003 , 0.097]	0.036
Right hippocampus	Olfactory score	0.050	[0.007 , 0.093]	0.024
	MoCA-J score	0.045	[0.001 , 0.088]	0.046
	Age	-0.501	[-0.547 , -0.456]	<0.001
	Sex	-0.228	[-0.277 , -0.178]	<0.001
	Education duration	-0.095	[-0.135 , -0.055]	<0.001
	Smoking history	0.045	[-0.001 , 0.092]	0.056
Left amygdala	Olfactory score	0.052	[0.006 , 0.098]	0.028
	MoCA-J score	0.057	[0.010 , 0.104]	0.017
	Age	-0.453	[-0.501 , -0.405]	<0.001
	Sex	-0.176	[-0.229 , -0.123]	<0.001
	Education duration	-0.060	[-0.102 , -0.017]	0.007
	Smoking history	0.061	[0.012 , 0.111]	0.016
Right parahippocampus	Olfactory score	0.039	[-0.007 , 0.085]	0.099
	MoCA-J score	0.049	[0.002 , 0.096]	0.043
	Age	-0.450	[-0.498 , -0.401]	<0.001
	Sex	-0.186	[-0.239 , -0.133]	<0.001
	Education duration	-0.094	[-0.137 , -0.051]	<0.001
	Smoking history	0.046	[-0.004 , 0.096]	0.072
Right olfactory cortex	Olfactory score	0.024	[-0.023 , 0.072]	0.321
	MoCA-J score	0.076	[0.028 , 0.124]	0.002
	Age	-0.401	[-0.451 , -0.351]	<0.001
	Sex	-0.202	[-0.257 , -0.148]	<0.001
	Education duration	-0.047	[-0.091 , -0.003]	0.037
	Smoking history	0.051	[-0.00003 , 0.103]	0.050

CI, confidence interval.

Regressions were performed using olfactory score, MoCA-J score, age, sex, education duration, and smoking history as explanatory variables.

Supplementary Table S2. Age-group-stratified (<65 and ≥65 years) multiple regressions for

the right amygdala and left parahippocampus and sex-stratified multiple regressions for the

left olfactory cortex, with the adjustment for the MoCA-J score

		ROI	Explanatory and adjusted variables	Standardised partial regression coefficient		
				Estimate	[95% CI]	P-value
Stratification by age groups	Age <65 years	Right amygdala	Olfactory score	0.015	[-0.048 , 0.078]	0.646
			MoCA-J score	0.008	[-0.067 , 0.082]	0.836
			Age	-0.272	[-0.365 , -0.180]	<0.001
			Sex	-0.193	[-0.267 , -0.120]	<0.001
			Education duration	-0.114	[-0.178 , -0.051]	<0.001
			Smoking history	0.072	[0.007 , 0.138]	0.031
	Age ≥65 years	Right amygdala	Olfactory score	0.079	[0.012 , 0.146]	0.020
			MoCA-J score	0.075	[0.014 , 0.137]	0.016
			Age	-0.638	[-0.783 , -0.493]	<0.001
			Sex	-0.108	[-0.186 , -0.030]	0.007
			Education duration	-0.085	[-0.144 , -0.026]	0.005
			Smoking history	0.076	[-0.0002 , 0.152]	0.051
Stratification by sex	Men	Left olfactory cortex	Olfactory score	0.064	[-0.008 , 0.135]	0.079
			MoCA-J score	0.058	[-0.008 , 0.123]	0.084
			Age	-0.599	[-0.754 , -0.444]	<0.001
			Sex	-0.146	[-0.229 , -0.063]	0.001
			Education duration	-0.078	[-0.141 , -0.015]	0.016
			Smoking history	0.080	[-0.001 , 0.161]	0.054
	Women	Left olfactory cortex	Olfactory score	-0.040	[-0.123 , 0.043]	0.343
			MoCA-J score	0.078	[0.004 , 0.152]	0.040
			Age	-0.365	[-0.446 , -0.285]	<0.001
			Education duration	-0.061	[-0.123 , 0.001]	0.053
			Smoking history	0.062	[-0.015 , 0.140]	0.115
			Olfactory score	0.013	[-0.044 , 0.071]	0.651
MoCA-J score	0.088	[0.025 , 0.151]	0.006			
Age	-0.464	[-0.528 , -0.400]	<0.001			
Education duration	-0.038	[-0.100 , 0.025]	0.237			
Smoking history	0.022	[-0.047 , 0.090]	0.534			

CI, confidence interval.

Regressions were performed using olfactory score, MoCA-J score, age, sex, education duration, and smoking history as explanatory variables in the age group stratification analysis and using olfactory score, MoCA-J score, age, education duration, and smoking history as explanatory variables in the sex stratification analysis.

Supplementary Table S3. Standardised partial regression coefficients for the interaction terms between age groups (age <60, 60-69, and ≥ 70 years) and olfactory test scores in multiple regression analysis for ICV-normalised GMVs

Interaction terms	ROI	Regression coefficient of the interaction term		
		Estimate	[95% CI]	<i>P</i> -value
Age group \times olfactory score	Left hippocampus	0.025	[-0.015 , 0.064]	0.223
	Right hippocampus	0.026	[-0.013 , 0.066]	0.188
	Left amygdala	0.020	[-0.022 , 0.062]	0.358
	Right amygdala	0.053	[0.011 , 0.096]	0.013
	Left parahippocampus	0.043	[-0.001 , 0.086]	0.054
	Right parahippocampus	0.040	[-0.002 , 0.083]	0.063
	Left olfactory cortex	-0.032	[-0.075 , 0.011]	0.144
	Right olfactory cortex	-0.017	[-0.060 , 0.027]	0.448

CI, confidence interval; ICV, intracranial volume; GMV, grey matter volume.

Regressions were performed using olfactory score, age, sex, education duration, smoking history, and the interaction term as explanatory variables and ICV-normalised GMVs as objective variables.

Numbers of samples: 486, 490, and 468 for people aged <60, 60-69, and ≥ 70 years, respectively.

Supplementary Table S4. Standardised partial regression coefficients for the interaction terms between age groups (age <55, 55-64, 65-74, and ≥ 75 years) and olfactory test scores in multiple regression analysis for ICV-normalised GMVs

Interaction terms	ROI	Regression coefficient of the interaction term			
		Estimate	[95% CI]		<i>P</i> -value
Age group \times olfactory score	Left hippocampus	-0.111	[-0.244	, 0.023] 0.104
	Right hippocampus	-0.073	[-0.206	, 0.060] 0.284
	Left amygdala	-0.130	[-0.272	, 0.013] 0.074
	Right amygdala	-0.087	[-0.230	, 0.056] 0.234
	Left parahippocampus	-0.104	[-0.250	, 0.043] 0.164
	Right parahippocampus	-0.038	[-0.182	, 0.105] 0.600
	Left olfactory cortex	-0.051	[-0.197	, 0.095] 0.494
	Right olfactory cortex	-0.032	[-0.179	, 0.115] 0.673

CI, confidence interval; ICV, intracranial volume; GMV, grey matter volume.

Regressions were performed using olfactory score, age, sex, education duration, smoking history, and interaction term as explanatory variables and ICV-normalised GMVs as objective variables.

Numbers of samples: 309, 386, 589, and 160 for people aged <55, 55-64, 65-74, and ≥ 75 years, respectively.