# Supplementary Material

Microstructure of Brain Nuclei in Early Parkinson's Disease: Longitudinal Diffusion Kurtosis Imaging

Supplementary Figure 1. Radial plots of baseline diffusion kurtosis indices for each ROI in both groups. Visual comparison of Parkinson's and control groups on all diffusion and kurtosis measures across each region of interest at baseline. The values are scaled from 0 (at the center) to 1 (at the outer edge). Values were normalized such that the overall area of a plot can be compared across regions. Areas with a perfect overlap suggest no differences between groups, and areas with differences in the area of the shaded region suggest group differences.
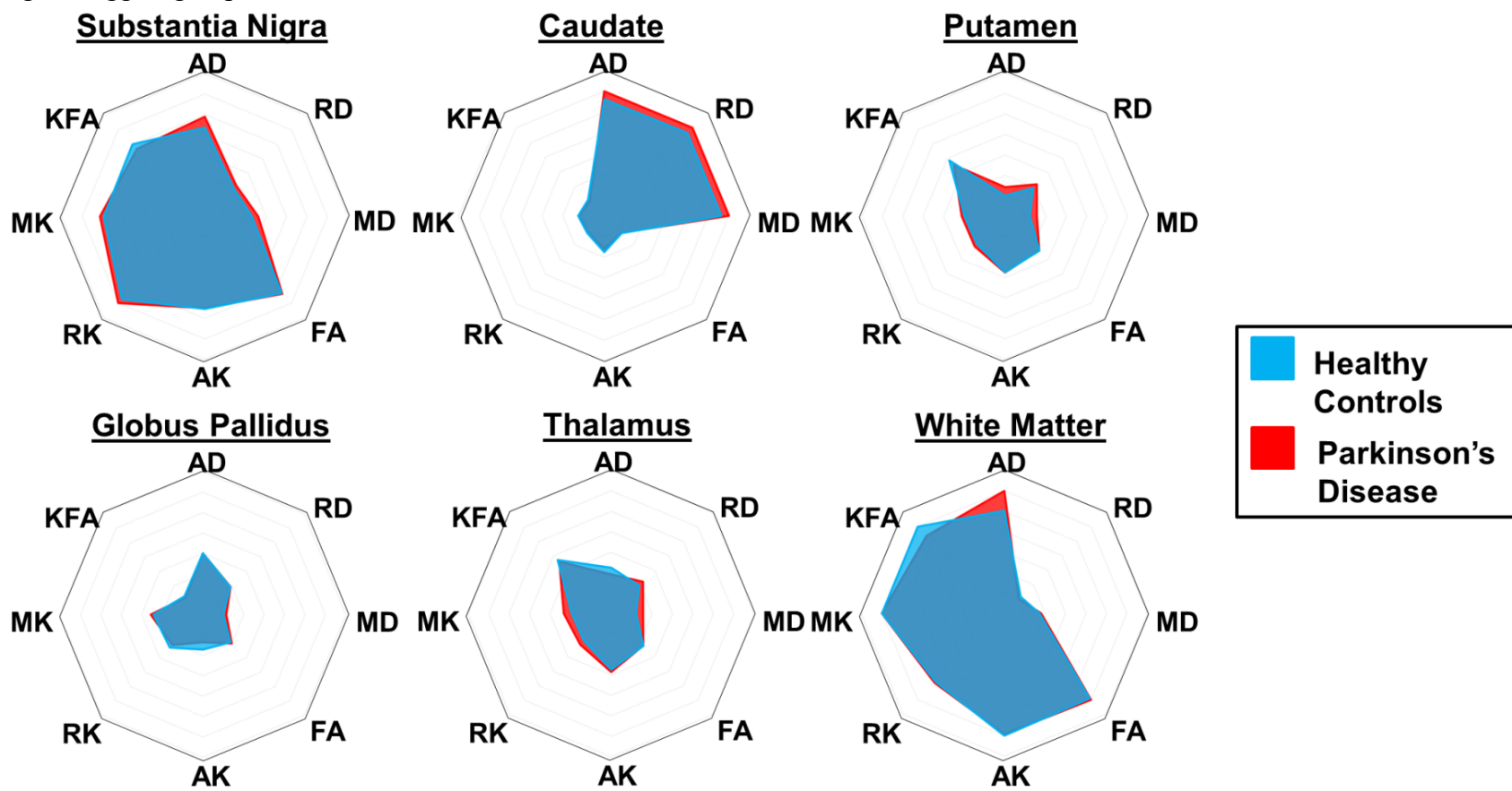
Supplementary Table 1. Results of the linear regression analysis of mean kurtosis at baseline comparing Parkinson's disease and control groups. Controlling for age, sex, and levodopa-equivalent dose. The group mean kurtosis is shown as mean (standard deviation).

ROIs	Group Means		Regression result for "group"		
	Parkinson's disease	Healthy controls	t	p	B
Substantia nigra	1.188 (0.079)	1.167 (0.098)	-2.226	0.027*	-0.161
Globus pallidus	0.899 (0.068)	0.872 (0.069)	-2.318	0.022*	-0.168
Putamen	0.844 (0.064)	0.828 (0.061)	-2.599	0.010**	-0.188
Caudate	0.748 (0.040)	0.734 (0.042)	-1.870	0.061	-0.131
Thalamus	0.860 (0.065)	0.816 (0.070)	-4.093	<0.001**	-0.288
Cerebral white matter	1.287 (0.043)	1.287 (0.048)	-0.601	0.548	-0.044

*Significant at α=0.05; **Significant at α=0.01; B, standardized beta coefficient.

Supplementary Table 2. Results of repeated-measures ANOVA to test interaction of time (baseline and 2-year follow-up) and group (early PD vs. controls). All cells show the effect size (partial eta squared, η_p^2) and the p-value.

	Interaction effect (time × group; η_p^2, p)
Substantia nigra	0.076, 0.191
Globus pallidus	0.099, <0.001 *
Putamen	0.110, <0.001 *
Caudate	0.010, 0.582
Thalamus	0.084, 0.015 *
Cerebral white matter	0.008, 0.794

* Significant at α=0.05.

Supplementary Table 3. Results of repeated measures ANOVAs to test the "time × group" interaction on diffusion tensor and kurtosis metrics while controlling for age, sex, LEDD and years of education. Each cell shows the p-value for the group difference.

	Diffusion tensor metrics				Diffusion kurtosis metrics			
	Axial	**Radial**	**Mean**	**Fractional anisotropy**	**Axial**	**Radial**	**Mean**	**Fractional anisotropy**
Substantia nigra	0.384	0.491	0.942	0.932	0.041*	0.378	0.191	0.071
Caudate	0.437	0.422	0.878	0.511	0.676	0.383	0.582	0.425
Putamen	0.143	0.045*	0.143	0.351	<0.001**	0.165	<0.001**	0.277
Thalamus	0.152	0.146	0.233	0.231	0.011*	0.272	0.015*	0.334
Globus Pallidus	0.363	0.391	0.977	0.128	<0.001**	0.346	<0.001**	0.274
White Matter	0.794	0.593	0.443	0.994	0.947	0.615	0.794	0.389

* Significant at $\alpha=0.05$; ** Significant at $\alpha=0.01$.

Supplementary Table 4. Results of correlations between MK and clinical scores for motor and cognitive performance in the PD group.

	2-year change in MK vs. 2-year change in MDS-UPDRS-III		2-year change in MK vs. 2-year change in MoCA	
	p	**r**	**p**	**r**
Substantia nigra	0.404	0.09	0.891	0.02
Globus pallidus	0.433	0.08	0.192	-0.21
Putamen	0.497	0.07	0.064	-0.22
Caudate	0.921	0.01	0.381	-0.10
Thalamus	0.414	0.09	0.059	-0.22
Cerebral white matter	0.063	0.22	0.311	-0.13

* Significant at α=0.05.
MDS-UPDRS-III, Movement Disorder Society Unified Parkinson's Disease Rating Scale Part III; MoCA, Montreal Cognitive Assessment.