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7 In summary, WMHs and subcortical brain atrophy observed on MRI scans of
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9 elderly diabetics without symptomatic brain infarctions were found to be
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11 associated with impaired speed of mental processes and memory, while WMHs
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13 are thought to be responsible for degenerative changes of cerebral small
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15 vessels and to be implicated in the pathogenesis of cognitive impairment. These
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17 findings suggest that periventricular WMHs and subcortical atrophy in particular
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19 constitute predictors of the rate of cognitive dysfunction in elderly diabetics and
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21 may underlie progression towards severe cognitive impairment. Our prospective
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23 J-EDIT study should help to determine the factors that can prevent cognitive
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25 dysfunction in elderly diabetics.
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37 **Acknowledgements**

38
39 This work was supported by a Research Grant for Longevity Sciences from the
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41 Ministry of Health, Labour and Welfare, Japan, and a grant from the Novartis
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43 Foundation for Gerontological Research (T.S.).
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Table 1 Clinical Characteristics of elderly patients with diabetes mellitus

	N	Mean±SEM
<i>Clinical character</i>		
Age (years)	95	72.8±0.5
Male: Female	38 : 57	
Education (years)	77	10.7±0.3
Duration of diabetes mellitus (years)	92	18.4±1.2
Body mass index (kg/m ²)	92	23.2±0.4
Waist/hip ratio	92	0.92±0.0
Systolic blood pressure (mmHg)	95	135.4±1.2
Diastolic blood pressure (mmHg)	95	75.5±0.9
Cardiovascular complication	95	0.16±0.0
Microvascular complication score	74	-0.02±0.1
Fasting blood glucose (mg/dl)	82	164.2±5.1
HbA1c (%)	95	7.9±0.1
Insulin	77	9.3±1.3
Total cholesterol (mg/dl)	95	203.4±3.2
Triglyceride (mg/dl)	95	150.1±12.8
HDL cholesterol (mg/dl)	94	65.0±2.7
<i>Cognitive function</i>		
Mini-mental state examination	80	26.2±0.3
Immediate word-list recall	81	8.2±0.2
Delayed word-list recall	80	6.8±0.3
Immediate paragraph recall	80	7.5±0.3
Delayed paragraph recall	80	5.8±0.3
Stroop test (A)	80	18.8±1.4
Digit symbol substitution test	77	35.8±1.2
<i>MRI</i>		
White matter hyperintensities		
Frontal lobe (ml)	95	1.8±0.2
Parietal lobe (ml)	95	1.0±0.1
Temporal lobe (ml)	95	0.8±0.1
Occipital lobe (ml)	95	0.3±0.1
Thalamus (ml)	95	0.1±0.0
Basal ganglia (ml)	95	0.3±0.0
Total (ml)	95	4.3±0.4
Periventricular hyperintensity	86	9.7±0.31
Evans ratio	95	26.0±0.34
Caudate head index	95	13.5±0.25
inverse Cella media index	95	26.3±0.40
Basal cistern index	95	19.6±0.27

Table 2 Pearson correlation coefficient between cognitive function and other factors

	word-list recall		paragraph recall		MMSE	Stroop digit symbol	WAIS-R
	Immediate	Delayed	Immediate	Delayed			
Age	-0.37	-0.44	-0.16	-0.24	-0.18	0.21	-0.27
Education	0.28	0.34	0.35	0.29	0.21	0.01	0.36
Duration of diabetes mellitus	-0.07	-0.20	-0.08	-0.21	-0.22	0.03	-0.24
Body mass index	0.05	0.10	0.00	0.12	0.23	-0.22	0.10
Systolic blood pressure	-0.04	-0.04	0.00	-0.04	0.01	-0.01	-0.05
Diastolic blood pressure	0.04	0.05	0.16	0.24	0.04	0.01	0.12
Cardiovascular complication	0.06	0.01	-0.08	-0.03	-0.20	0.17	-0.21
Microvascular complication score	-0.13	-0.08	-0.14	-0.07	0.18	-0.06	-0.04
Fasting blood glucose	-0.04	0.04	-0.01	-0.02	-0.12	0.08	-0.10
HbA1c	0.07	0.08	0.07	-0.02	0.07	0.01	-0.07
Insulin	0.12	0.02	-0.08	-0.04	0.05	-0.08	0.01
Total cholesterol	0.07	0.16	0.15	0.28	0.07	-0.10	0.07
Triglyceride	0.04	0.10	0.11	0.17	0.20	0.00	0.08
HDL cholesterol	0.12	0.14	-0.03	0.02	-0.02	-0.11	0.06
Evans ratio	-0.39	-0.19	-0.09	-0.18	-0.03	0.07	-0.36
Caudate head index	-0.35	-0.26	0.00	-0.14	-0.09	0.06	-0.19
inverse Cella media index	-0.41	-0.23	-0.09	-0.27	-0.09	0.04	-0.40
Basal cistern index	-0.12	-0.10	-0.12	-0.10	-0.20	-0.13	-0.21

Table 3 Canonical correlation between cognitive function and WMHs

Canonical correlation coefficient; 0.65		P=0.004	
Immediate word-list recall	0.22	WMHs of frontal lobe	-0.03
Delayed word-list recall	0.32	WMHs of parietal lobe	-0.21
Immediate paragraph recall	0.07	WMHs of temporal lobe	-0.23
Delayed paragraph recall	0.17	WMHs of occipital lobe	0.19
MMSE	0.39	Thalamus	-0.21
Stroop test (A)	-0.25	Basal ganglia	-0.10
Digit symbol substitution test	0.48	Total WMHs	-0.22
		Periventricular hyperintensity	-0.32

Each value represents correlation of canonical valuables.

Table 4 Canonical correlation between cognitive function and clinical indices

Canonical correlation coefficient; 0.78		p=0.881	
Immediate word-list recall	0.25	Age	0.16
Delayed word-list recall	0.11	Education	-0.09
Immediate paragraph recall	-0.08	Duration of diabetes mellitus	-0.13
Delayed paragraph recall	0.16	Body mass index	-0.14
MMSE	-0.46	Waist/hip ratio	0.06
Stroop test (A)	0.47	Systolic blood pressure	0.14
Digit symbol substitution test	0.07	Diastolic blood pressure	0.23
		Cardiovascular complication	-0.20
		Microvascular complication	0.07
		Fasting blood glucose	0.28
		HbA1c	0.05
		Insulin	0.51
		Total-cholesterol	0.09
		Triglyceride	-0.02
		HDL-cholesterol	0.00

Each value represents correlation of canonical valuables.

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Table 5 Canonical correlation between WMHs and clinical indices

Canonical correlation coefficient; 0.87		p=0.500	
WMHs of frontal lobe	0.28	Age	0.39
WMHs of parietal lobe	0.19	Education	0.02
WMHs of temporal lobe	0.37	Duration of diabetes mellitus	0.16
WMHs of occipital lobe	-0.01	Body mass index	-0.07
Thalamus	0.67	Waist/hip ratio	-0.12
Basal ganglia	0.12	Systolic blood pressure	0.26
Total WMHs	0.39	Diastolic blood pressure	0.14
Periventricular hyperintensity	0.31	Cardiovascular complication	-0.29
		Microvascular complication	-0.15
		Fasting blood glucose	-0.12
		HbA1c	0.10
		Insulin	-0.09
		Total-cholesterol	-0.17
		Triglyceride	-0.08
		HDL-cholesterol	-0.02

Each value represents correlation of canonical valuables.

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Table 6 Canonical correlation between cognitive function and subcortical brain atrophy

Canonical correlation coefficient; 0.61		p=0.010	
Immediate word-list recall	-0.50	Evans ratio	0.52
Delayed word-list recall	-0.38	Caudate head index	0.50
Immediate paragraph recall	-0.17	inverse Cella media index	0.55
Delayed paragraph recall	-0.33	Basal cistern index	0.20
MMSE	-0.19		
Stroop test (A)	0.30		
Digit symbol substitution test	-0.43		

Each value represents correlation of canonical valuables.

Table 7 Canonical correlation between subcortical brain atrophy and clinical indices

Canonical correlation coefficient; 0.65		p=0.999	
Evans ratio	0.50	Age	0.33
Caudate head index	0.23	Education	-0.27
inverse Cella media index	0.60	Duration of diabetes mellitus	0.26
Basal cistern index	-0.17	Body mass index	0.16
		Waist/hip ratio	0.05
		Systolic blood pressure	0.11
		Diastolic blood pressure	-0.04
		Cardiovascular complication	0.23
		Microvascular complication	0.16
		Fasting blood glucose	0.05
		HbA1c	0.05
		Insulin	0.13
		Total-cholesterol	-0.04
		Triglyceride	0.10
		HDL-cholesterol	-0.11

Each value represents correlation of canonical valuables.

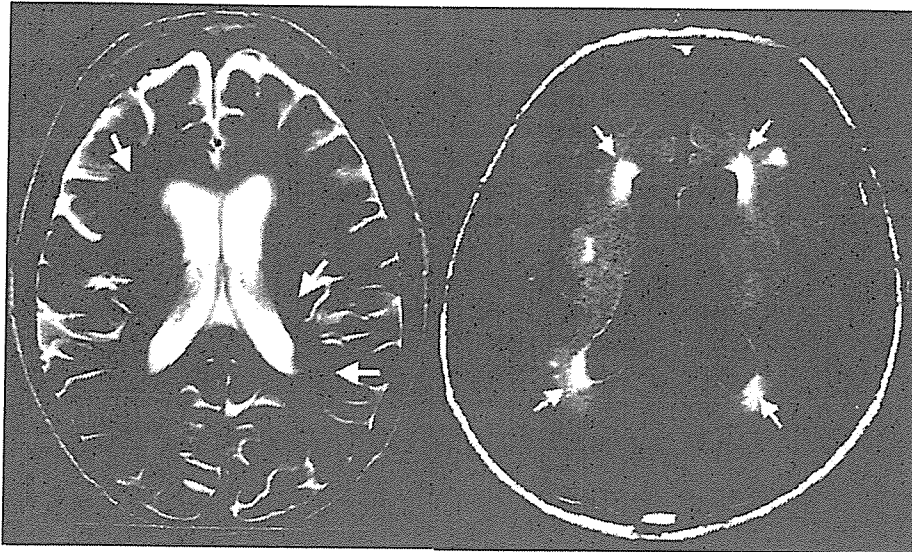


Figure 1 An example of subcortical (left) and periventricular (right) white matter hyperintensities on brain MR imaging.

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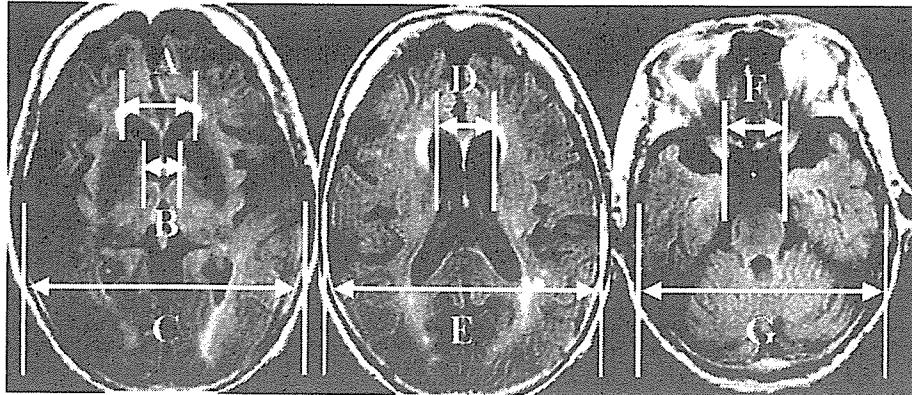


Figure 2 Measured portions on MR imaging. A, the maximum distance between the tips of the anterior horns; B the width between the bilateral heads of the caudate nuclei; C, the maximum transverse inner diameter of the cranial space at the same MR section (left); D, the maximum width of the cella mediae; E, the maximum transverse inner diameter at the same section (center); F, the internal width between the bilateral temporal lobe at the level of basal cistern; G, the maximum transverse inner diameter at the same level (right). Evans ratio= A/C , Caudate Head Index= B/C , inverse Cella Media Index= D/E , Basal Cistern Index= F/G .

Association of diastolic blood pressure and lower HbA1c with frontal brain atrophy in elderly diabetics

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