범주형 유창성의 노화와 한국인의 정상규준

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Verbal fluency

- Executive function, semantic memory, language

- Letter (phonemic) fluency

- Category (semantic) fluency

- Sensitive measure to brain damage

Benton 1968; Ruff et al., 1996; Rosen 1980,; Butters et al., 1987; Janowsky et al., 1989; Stuss et al., 1998

Category fluency test (CFT)

- Animal category is most commonly employed

- Clustering and switching

- Focal frontal cortical injury (executive function) and temporal lobe damage (semantic memory)

- Differential semantic memory deficit in AD → differential clinical utility from LFT

- Useful screening tool for mild AD

Barr and Brandt 1996; Monsch et al., 1992; Pihlajamaki et al., 2000; Abrahams et al., 2003; Henry et al., 2004; Caramelli et al., 2007

CFT as a screening for AD

- CFT cut-off score, sensitivity and specificity

Educational level	Cut-off	Sensitivity (%)	Specificity (%)	Authors
-	<15	88	96	Canning et al. (2004)
0	<9	90.5	80.6	Caramelli et al. (2007)
1-3	<12	95.2	80.0	
4-7	<12	91.3	91.9	
>7	<13	82.6	100	

- CFT features and incident AD from a longitudinal study

Canning et al., 2004; Caramelli et al., 2007; Auriacombe et al. 2006

Demographic influence of CFT

- Age

- Education

- Gender

- Ethnic

Rossselli et al., 1990; Ratcliff et al., 1998; Carnero et al., 1999; Kempler et al., 1998; Ostrosky-Solis et al., 1999; Acevedo et al., 2000; Brucki et al., 2004; Lee et al., 2004

Normative data for CFT form KLOSCAD

- Nationwide data from community-based cohort studies

  - Korean Longitudinal Study on Health and Aging (KLoSHA)

  - Ansan Geriatric Study (AGE)

  - Gwangju Dementia and Mild Cognitive Impairment Study (GDEMCIS)

  - Nationwide Study on the Prevalence of Dementia in Korea (2008)

Subjects

- Examined by trained psychiatrists

- CERAD-K CA

- MINI version 5.0

- GDS-K short version

- Not demented nor depressive (GDS-K < 8)

- No major psychiatric disorders, no serious medical and neurological disorders

Test for verbal fluency in the study

- Verbal fluency using animal category in CERAD-K NP

- Name as many examples of the category "animal" as possible within 1 min.

- Standardized the administration through instruction manual and rater training

Demographic characteristics

Variable	Men	Women	Total
Number	1420	1605	**3025**
Age (years)	71.81($\pm$6.6)[a]	71.55($\pm$6.8)	71.67($\pm$6.7)
60-64	130(9.2)[b]	183(11.4)	313(10.3)
65-69	466(32.8)	545(34.0)	1011(33.4)
70-74	439(30.9)	446(27.8)	885(29.3)
75-79	215(15.1)	226(14.1)	441(14.6)
80-84	67(4.7)	96(6.0)	163(5.4)
85-89	82(5.8)	82(5.1)	164(5.4)
90-96	21(1.5)	27(1.7)	48(1.6)
Education (years)	9.83($\pm$4.8)	5.16($\pm$4.6)***	7.35($\pm$5.2)
0	70(4.9)	468(29.2)	538(17.8)
1-3	58(4.1)	184(11.5)	242(8.0)
4-6	334(23.5)	502(31.3)	836(27.6)
7-9	278(19.6)	183(11.4)	461(15.2)
10-12	311(21.9)	178(11.1)	489(16.2)
13-16	301(21.2)	86(5.4)	387(12.8)
17-	68(4.8)	4(0.2)	72(2.4)

[a]Mean $\pm$ SD, [b]Number (percent), ***$p<0.001$, Independent Samples t test

Stepwise multiple linear regression of age, education, and gender on CFT score

	Category Fluency Test			
	B	SE(B)	β	R^2
Education	0.28	0.01	0.34***	**14.00**
Age	-0.12	0.01	-0.18***	**3.20**
Gender	-0.28	0.16	-0.03	**0.00**

Note. B = regression coefficient; SE(B) = standard error of B; β = standardized regression coefficient; R^2 = percent variance explained by each variable.

Age and education were entered as continuous variables, and gender was coded as 0 and 1 for male and female, respectively.

***$p < 0.001$.

The 6×6×2 analysis of variance for main effects and interactions among age, education, and gender on CFT

Main effect		Interaction	
Variable	***F***	**Variable**	***F***
Age	**7.73*****	Age * Education	0.59
Education	**22.86*****	Age * Gender	0.98
Gender	0.01	Education * Gender	0.59

Note. Age is categorized as "60-64, 65-69, 70-74, 75-79, 80-84, and ≥85 years," educational level as "0, 1-3, 4-6, 7-9, 10-12, and ≥ 13 years," and gender as "men and women."
*p < 0.05, **p < 0.01, ***p < 0.001
by 6×6×2 analysis of variance (ANOVA).

Effect of gender on CFT

- **No effect on the performance**

- Most previous studies not found 'gender effect' on CFT

- Some studies: conflicting results

Crossly et al. 1997; Kempler et al., 1998; Lucas et al. 1998; Chen and Poon 1999; Acevedo et al., 2000; Brucki SM, Rocha MS 2004; Lee et al., 2004;

Effect of age and education on CFT

- **Associated with age and education**

- **Education was more influential than age**

- Previous studies: conflicting results

  ⇒ education > age

  ⇒ age only, no educational influence

  ⇒ education only, no age effect

Lee et al., 2004; Brucki and Rocha 2004; Lucas et al., 1998; Welsh et al., 1994

Effect of age and education on CFT

- Age influence only study: subjects with Caucasian population, more than 9 years education

- Predominant educational influence: the population with diverse educational level (uneducated to graduate level)

Lee et al., 2004; Brucki and Rocha 2004; Lucas et al., 1998; Welsh et al., 1994

CFT performance and aging

- Performance of CFT declines with normal aging
    - Psychomotor s slowing
    - Declines of semantic memory

- CFT performance is more influenced by normal aging than LFT performance, as cognitive disorders those are MCI and AD

    ⇒ potential use of screening tool for AD

Kozora and cullum 1995; Tomer and Levin 1993; Tombaugh et al., 1999; Rodriguez-Aranda 2003; Rodriquez-Aranda et al., 2006; Salmon et al., 1999

Normative data of category fluency test in Korean elders

Age	Education (yrs)	0	1-6	7-9	10-12	≥13
60 -69[a]	Number	300	812	352	385	360
	Mean±SD	11.21±3.82	12.66±3.69	13.84±4.08	14.79±4.44	15.78±4.10
	Median	11.00	13.00	14.00	14.00	15.00
	5-95 percentile	5.00-17.00	7.00-19.00	8.00-21.00	9.00-22.70	9.00-23.00
70 -74[b]	Number	381	845	353	385	373
	Mean±SD	10.87±3.92	12.41±3.64	13.42±3.80	14.59±4.42	15.35±3.96
	Median	11.00	12.00	13.00	14.00	15.00
	5-95 percentile	5.00-17.00	7.00-18.70	7.00-21.00	8.00-22.70	9.00-23.00
75 -79[c]	Number	298	517	224	237	213
	Mean±SD	10.20±3.86	11.92±3.63	13.09±3.99	14.42±4.30	14.67±3.66
	Median	10.00	12.00	13.00	14.00	14.00
	5-95 percentile	4.00-17.00	6.00-18.00	7.00-20.00	7.90-22.00	9.00-21.30
80 -84[d]	Number	212	253	107	99	97
	Mean±SD	9.65±4.08	11.61±3.33	12.74±3.56	13.96±4.53	14.07±3.37
	Median	10.00	12.00	13.00	14.00	14.00
	5-95 percentile	2.00-17.00	6.00-17.00	7.00-19.00	7.00-22.00	9.00-20.00
≥85[e]	Number	136	112	39	49	39
	Mean±SD	9.22±4.18	11.16±3.54	12.23±3.63	13.39±3.66	13.95±3.47
	Median	10.00	11.00	12.00	13.00	14.00
	5-95 percentile	2.00-16.15	5.65-17.00	7.00-19.00	7.00-19.00	9.00-20.00

[a]Normative data from age group 60-74 yrs. [b]from age group 65-79 yrs,
[c]from age group 70-84 yrs. [d]from age group 75-89 yrs, [e]from age group 80-95 yrs.

Normative data of CFT in the study

- CFT performance is considerably influenced by education and age

- Comprehensive data from educationally diverse Korean elders

- Adopted overlapping age stratification method
  - More stratified tables with adequate cell number
  - Less abrupt mean shifts between age strata

Pauker 1988

Strength of this normative data

- Adequate sample size as a comprehensive normative data

- Strictly excluded cognitive and mood disorders

- Wide educational range

CONCLUSIONS

- Education and age, not gender, influence category fluency in the elderly

- Education is most influential demographic factor

- This age- and education-specific normative data for Korean elderly can be used to assess cognitive function effectively