

Establishing Reference Values for a New Computerized Cognitive Function Test Program for Children

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Introduction

▷ We have developed a new computerized cognitive function test program (eCFT) for children: Bettercog Kids version software

▷ The aim of this study:

- Establishing the reference value for eCFT
- Determining whether there is a trend of increasing cognitive function as children age

Material and Methods

▷ Participants

- Children aged 3 to 6 years olds
- Identified as having normal development through the K-DST and K-ABC-II test

▷ Undergoing K-DST, K-ABC-II, and eCFT assessments consecutively

- Total time required : 2 hours
- eCFT : 40 minutes to complete

▷ eCFT

- 8 Subtests : attention, learning/memory, perceptual-motor function, executive function
- Collecting the number of correct answers, incorrect answers, incomplete responses, reaction time, the number of completed stages

Results

▷ A total of 66 subjects

-M 36, F 30 (Average age : 4.4 years)

1. We suggest a reference range for normal cognitive function between 15% and 85% of the test results
2. The tendency of increasing number of correct answer and shorter reaction times as children age.

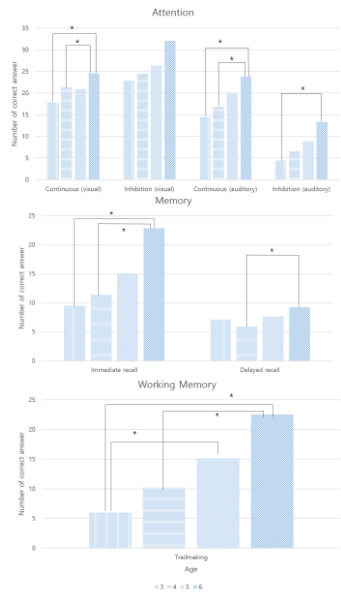
<Table 1. Baseline characteristics of participants>

Characteristics				
Age (years)	N	Gender (female, %)	K-DST Mean (min, max)	K-ABC-II Mean (range)
3	15	8 (53.3)	129 (117, 142)	104 (62, 142)
4	21	7 (33.3)	126 (103, 140)	191 (104, 1297)
5	16	8 (50.0)	125 (100, 137)	250 (147, 1161)
6	14	7 (50.0)	138 (131, 144)	1061 (143, 1274)
Total	66	30 (45.5)	127	370

<Table 2. Test results according to age group>

	Age	N	Number of correct answer				Reaction time			
			Mean±S.D.	15th %	85th %	Mean±S.D.	15th %	85th %		
Finding half test	3	12	13.5 ± 4.6	8.8	19.0	4.01 ± 1.78	2.32	5.71		
	4	21	18.3 ± 2.3	15.3	20.0	3.61 ± 1.54	2.37	4.84		
	5	15	18.3 ± 1.4	17.0	19.6	3.28 ± 1.50	1.97	4.59		
	6	14	17.1 ± 4.6	15.3	20.0	2.53 ± 1.04	1.66	3.21		
Continuous performance (visual 1)	3	13	17.9 ± 4.6	11.1	22.0	1.30 ± 0.52	0.84	1.79		
	4	21	21.4 ± 4.0	17.3	24.0	0.96 ± 0.48	0.58	1.33		
	5	15	20.9 ± 2.0	19.6	25.0	0.81 ± 0.39	0.52	1.22		
	6	14	24.6 ± 1.1	24.0	25.0	0.58 ± 0.24	0.42	0.73		
Inhibition control test (visual 2)	3	12	22.9 ± 13.1	5.0	31.2	1.00 ± 0.51	0.57	1.43		
	4	21	24.6 ± 5.9	17.3	29.0	0.70 ± 0.51	0.27	1.00		
	5	15	26.3 ± 4.3	20.4	29.8	0.61 ± 0.44	0.23	0.96		
	6	14	32.1 ± 9.8	28.0	48.8	0.44 ± 0.37	0.13	0.82		
Continuous performance (auditory 1)	3	11	14.5 ± 5.8	6.6	22.0	1.14 ± 0.65	0.40	1.73		
	4	21	16.9 ± 6.4	7.6	23.0	1.14 ± 0.53	0.64	1.61		
	5	15	19.9 ± 5.2	12.6	24.2	1.08 ± 0.52	0.63	1.53		
	6	14	23.8 ± 1.9	20.8	25.0	0.91 ± 0.38	0.61	1.28		
Inhibition control test (auditory 2)	3	10	4.4 ± 2.3	2.0	7.4	1.85 ± 0.69	1.27	2.43		
	4	19	6.5 ± 3.5	3.0	11.0	1.49 ± 0.56	0.88	1.97		
	5	14	8.9 ± 6.4	3.3	12.5	1.40 ± 0.37	1.12	1.69		
	6	14	13.3 ± 8.6	5.3	27.8	1.27 ± 0.50	0.86	1.79		
Immediate recall	3	14	9.5 ± 7.8	1.0	20.5	4.48 ± 2.41	1.79	7.25		
	4	20	11.5 ± 8.0	1.2	21.9	3.34 ± 2.10	1.38	5.32		
	5	14	15.0 ± 10.9	1.3	28.8	3.49 ± 2.06	1.51	5.53		
	6	14	22.8 ± 7.6	12.8	28.8	3.71 ± 2.18	1.63	5.74		
Delayed recall	3	11	7.1 ± 3.3	2.4	10.0	5.13 ± 2.22	3.30	7.65		
	4	20	6.0 ± 3.2	1.0	9.0	4.53 ± 1.95	2.64	6.87		
	5	14	7.6 ± 2.2	4.8	9.8	4.11 ± 1.82	2.47	5.98		
	6	12	9.3 ± 1.0	8.0	10.0	3.60 ± 1.42	2.42	4.88		
Trail-making	3	14	6.0 ± 6.6	0	14.0	4.63 ± 3.73	1.30	7.60		
	4	19	10.2 ± 8.7	0	20.0	3.66 ± 3.34	1.01	5.63		
	5	14	15.1 ± 8.2	3.3	26.8	2.94 ± 2.92	0.93	4.90		
	6	13	22.5 ± 8.0	15.3	28.0	2.16 ± 1.80	0.78	3.48		

<Figure 1. Comparison of cognitive function score among age groups by subset test>



Conclusion

- ▷ In general, the age 6 group had greater performance than the age 3 and age 4 groups.
- Attention/Memory/Working memory : Age 6 group > Age 3 and 4 groups

▷ eCFT in Bettercog: low-cost and easily accessible assessment tool in the community and rehabilitation hospital