

EFFECTS OF BLOOD LEAD ON INTELLIGENCE AND PERSONALITY IN SCHOOLCHILDREN

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Introduction

This study was conducted to evaluate the effects of lead concentration in the blood on intelligence and personality in school children in Korea.

Methods

Study subjects and area: The study conducted in three areas, Daegu (urban & industrial area), Gampo (fishery area), and Unyang (agricultural area) in South Korea. One primary school was selected in the middle of each area. The study subjects were 302 school age children pertaining to 154 of 3rd-grade and 155 of 6th-grade.

Written questionnaire: The parents of the children were asked to fill in a written questionnaire on following variables: age, level of education, alcohol consumption, smoking habit, habitual physical activity, employment status and economic status.

Lead assay: Venous blood was sampled using heparin containing vacuum tube for the analysis of lead. Blood lead (Pb-B) was measured by means of atomic absorption spectroscopy (AA-6800, Shimadzu) equipped with graphite furnace atomizer (GFA-EX7). Tube was used pyro-coated graphite tube. The lead concentration was determined by standard addition method.

Intelligence and personality test : The test was divided into two subtests for Intelligence and personality. Intelligence test was assessed using KIT-P set (Korean Institute for Research in the Behavior Science, Intelligence Test, and Primary). Personality test was assessed using KPI-C (Korean Personality Inventory for Children) set can be estimate a mental state such as behavior, cognitive, and emotion etc. KPI-C consist of 255 questionnaires, parents answered 'yes' or 'no' in chart. The test was performed according to standard instructions and evaluated using age norms; for the group of 3rd-grade and for the group of 6th-grade.

Results

Geometric means of Pb-B for boys and girls were 2.79 ± 1.58 $\mu\text{g/dL}$ and 2.54 ± 1.51 $\mu\text{g/dL}$, respectively. No children exceeded Pb-B of 10 $\mu\text{g/dL}$, which is the recommended level in children by CDC, U.S.A. When the subjects were classified by median into two groups, upper and lower Pb-B groups, the IQ of upper and lower groups were 106.4 ± 13.7 and 110.0 ± 14.9 respectively. IQ score of upper group was lowered about 4 points than that of lower group. We founded that hyperactivity and autism score of Pb-B groups was higher than that of lower group. These results are coincident with the large-scale study results developed countries that chronic exposure to lead may reduce the intelligence of child. This study may provide the first suggestive evidence that Pb-B has an impact on childhood intelligence and personality in Korean children. It is necessary to consider the effects of other important factors, such as parental intelligence in the next study.

Table 1. Blood lead concentrations of subjects.

Sex	Area				P-value
	Urban (99)	Fishery (106)	Agricultural (97)	Total	
Boys	2.81 ± 1.53	3.31 ± 1.46	2.19 ± 1.65	2.79 ± 1.58	0.000
Girls	2.44 ± 1.57	2.94 ± 1.56	2.31 ± 1.38	2.54 ± 1.51	0.015
Total	2.66 ± 1.55	3.16 ± 1.50	2.25 ± 1.52	2.68 ± 1.55	0.000

Geometric mean; Geometric standard deviation

Table 2. Comparison of cognitive ability and personality by blood lead level.

Parameter	GM ± GSD	Blood lead level		P-value
		Lower (151)	Upper (151)	
PbB (µg/dL)		1.92 (1.41)	3.74 (1.23)	
Cognitive ability	Intelligence (IQ)	110.0 ± 14.9	106.4 ± 13.7	0.034
	Vocabulary (T)	54.6 ± 10.4	52.6 ± 9.1	0.070
	Inference (T)	55.9 ± 9.6	54.0 ± 8.3	0.063
	Mathematics (T)	54.4 ± 10.0	53.2 ± 9.4	0.296
	Perception (T)	54.3 ± 9.7	52.6 ± 9.2	0.123
Personal ability	Egotistic (T) ⁺	50.2 ± 10.3	50.4 ± 10.6	0.902
	Vocabulary development (T)	48.2 ± 10.2	49.3 ± 10.9	0.399
	Position development (T)	48.4 ± 10.5	48.9 ± 10.2	0.654
	Anxiety (T)	50.3 ± 11.5	49.2 ± 11.1	0.395
	Depression (T)	47.8 ± 11.1	47.9 ± 11.5	0.393
	Structure (T)	47.7 ± 9.9	47.0 ± 10.4	0.552
	Delinquent (T)	46.3 ± 8.6	48.0 ± 10.4	0.131
	Hyperactivity (T)	43.2 ± 10.7	46.1 ± 12.9	0.037
	Family relation (T)	48.0 ± 9.3	50.2 ± 10.6	0.058
	Social relation (T)	52.4 ± 7.9	52.1 ± 7.4	0.727
	Psychosis (T)	34.8 ± 15.5	36.4 ± 17.8	0.405
	Autism (T)	39.7 ± 14.0	43.9 ± 14.1	0.012

Conclusion

The main finding of our study was that cognitive and personality of children had an association with the level of blood lead concentration (classified by median into upper and lower Pb-B groups). Our study also compared the difference by areas. According to intelligence and personality test by area, the results showed similar score except for perception ability. We identified that hyperactivity score was higher than that of lower group and autism score was higher than lower group in high blood lead group. It suggests that high blood lead level can cause autisms. In conclusion, childhood exposure to lead can reduce intelligence and cognitive development and further study is recommended to consecutive concern and control to children's lead exposure.

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