TRANSLATIONS OF TWELVE CHINESE STUDIES ON DEVELOPMENTAL FLUORIDE NEUROTOXICITY

The following are English translations of 12 reports dealing with neurological effects of fluoride that were originally published in Chinese research journals between 1990 and 2004. The translations were commissioned by and provided to *Fluoride* by the Fluoride Action Network (FAN) of Canton, NY. The first 11 translations were made by Julian Brooke, a young scholar who has studied and traveled in China. The translation of the 12th report was made by Bin Li, PhD, a professional Chinese-English translator. Summaries and Keywords appearing in brackets were written by the present editors.

As can be seen in the references cited in these reports and others that have appeared in *Fluoride*, there are many other related papers in the Chinese scientific literature that might have been selected. Nevertheless, those included here are a representative cross section of topics in this area of fluoride research. Although relatively unknown among many researchers outside of China, these studies, which are now made widely available for the first time in English, are of great importance worldwide for a fuller understanding of how fluoride can affect neurological development, function, and performance.

The first two reports, published in 1990, are concerned with IQ levels of children living in areas with different levels of naturally occurring fluoride in the drinking water. Interestingly, in the earlier of these two studies (p. 115–119), performed by L Qin et al. in Jing County, Hubei Province, IQs were found to be highest in 9 to 10½ year-old children with 0.5–1.0 ppm F in their drinking water and lowest not only in children with high (2.1–4.0 ppm F) but also with low (0.1–0.2 ppm F) in their drinking water. No iodine intake levels or correlations with parental education, which are known to be very important for intelligence testing, were recorded.

The second 1990 study (p. 120–124), undertaken by Y Chen et al. in Linyi County, Shanxi Province, found that average IQs of 7–14 year-old children with 4.55 ppm F in their drinking water were significantly lower than those of age-matched children of either gender with 0.89 ppm F in their drinking water. In this work, higher IQ scores of the children also correlated with higher levels of parental education and employment.

The third study (p. 125–128), published in 1991 and conducted by X Guo et al., compared the IQs of 7–13 year-old children living in a fluoride-polluted coal-burning region of Hongxi Township in Xinshao County, Hunan Province, with IQs of children in a neighboring non-polluted wood-burning control area in the same township. Markedly lower IQs, especially among the younger

children, were found in the F-polluted area. As in the second study, a statistically significant higher percentage of children with greater fluoride exposure had low IQ scores.

In the fourth study (p. 129–133), reported in 1995 by N Wu and colleagues at Ninxia and Beijing Medical Universities, neural behavioral tests were done on rat pups whose mothers drank water containing up to 25 mg F/L. Among measurable adverse effects were differences in motor coordination, sensitivity to pain, and auditory reaction.

The fifth study (p. 134–138), published in 1996 by Y Yu et al. and conducted in Zhijin County, Guizhou Province, found disruption of normal neurotransmission and receptor levels in brain tissues of ten 5- to 7-month-old fetuses aborted from mothers with dental fluorosis living in an endemic fluoride area of Guizhou Province compared to the levels of these parameters in ten fetuses of the same age aborted from mothers without dental fluorosis in non-endemic Guizhou City.

The sixth study (p. 139–143), a laboratory investigation by Z Zhang et al. of Jinhua City appeared in 1999 and is similar to the fourth study except that it was initiated with month-old mice. In this investigation, the synaptic brain structure and learning-memory ability of the mice were shown to be adversely affected by sodium fluoride at concentrations up to 10 mg NaF/L in the drinking water.

In the seventh study (p. 144–147), published in 2000 by S Liu et al., an epidemiological survey was made of children's IQs in two socio-economically similar villages located 5 km apart in the Tianjin Xiqing District. With normal iodine levels in the drinking water, the average IQ of 60 randomly selected children age 10–12 with 3.15 mg F/L in the drinking water was found to be 10 points lower than in a similar group of 58 children with only 0.37 mg F/L in the drinking water.

The eighth study (p. 148–151), reported in 2000 and conducted by Z. Sun and co-workers at Tianjin Medical University, was similar to the sixth study. In it deleterious neurological effects of fluoride at concentrations of 10, 50, and 100 mg F/L in the drinking water were found after six months in adult mice on their cerebral function and performance testing.

In the ninth study (p. 152–155), a 2001 report by Z Guo and two co-authors at the Anwei Medical University, Hefei, the

neurobehavioral function of two groups of male workers exposed to fluoride for either more or less than five years in an electrolytic aluminum production plant was shown to have measurably greater deterioration compared to unexposed male controls of similar age.

The tenth study (p. 156–160), also published in 2001, was conducted by F. Hong et al. of Binzhou, Shandong. This investigation involved an examination of the effects of high (2.85–2.94 mg/L) and low (0.48 mg/L) fluoride together with high (1150 µg/L and low (0.75–0.91 µg/L) iodide in drinking water on intellectual development, thyroid function, and goiter and in 8–14 year-old randomly selected children from a fluoride endemic and a low-fluoride, normal iodide area control area. In addition, the impacts of parental and preschool education were also examined. Overall, the damaging effects of low or excessively high iodide in the water appeared to be more pronounced when high fluoride (~2.9 mg/L) was also present. In the high fluoride and control areas with normal iodide levels, the average IQ scores of the children were not significantly different.

The eleventh study (p. 161–164), published in 2003, was an investigation by Y Li and colleagues, of the IQs of children living in an endemic fluoride area compared to a low fluoride area of the Baotou region of Inner Mongolia. Lower IQs correlated closely with dental fluorosis. The percentage of low IQ scores was greater in the fluoride area than in the control area. In the endemic fluoride area, girls had a greater proportion of low IQs than boys, but the differences were not statistically significant.

In the twelfth study (p. 165–170), published in 2004, J Li et al. of Daqing investigated the effects of excessive fluoride intake during pregnancy on neonatal neurobehavioral development and the neurotoxicity of fluoride in Zhaozhou County, Heilongjiang Province. Both neurobehavioral development and neurological assessment showed poorer scores for the neonates born of 44 mothers from areas with 1.7–6.0 mg F/L in the drinking water than for those born of 47 mothers from the areas with 0.5–1.0 mg F/L in the drinking water.

Comparison of the findings of these 12 studies with those of other research reports published in *Fluoride* reveals a fairly consistent pattern of adverse effects by fluoride on brain biochemistry and neurological development and behavior or performance.[1-10] Further studies in regard to potential confounding factors, like lead and arsenic, besides age, gender, iodine intake levels, schooling, parental education, etc., are still ongoing.

ACKNOWLEDGEMENTS

We are most grateful to the Fluoride Action Network (FAN) for underwriting these translations and to Julian Brooke and Bin Li who made them.

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