REDUCED IQ IN CHILDREN

FLUORIDE AND CHILDREN'S INTELLIGENCE: A META-ANALYSIS

This paper presents a systematic literature review conducted to investigate whether fluoride exposure has increased the risk of low intelligence quotient (IQ) scores in China over the past 20 years. MEDLINE, SCI, and CNKI searches were organized for all documents published in English and Chinese between 1988 and 2008, using the following keywords: fluorosis, fluoride, intelligence, and IQ. Further searches were undertaken on the website www.fluorideresearch.org because this is a professional website concerning research on fluoride. Sixteen case-control studies that assessed the development of low IQ in children who had been exposed to fluoride early in life were included in this review. A qualitative review of the studies found a consistent and strong association between exposure to fluoride and low IQ. The meta-analyses of the case-control studies estimated the odds ratio of IQ in endemic fluoride areas compared with nonfluoride areas or slight fluoride areas. The summarized weighted mean difference is –4.97 (95% confidence interval [CI] = –5.58 to –4.36; p<0.01) using a fixed effect model and –5.03 (95% CI= –6.51 to –3.55; p<0.01) using a random-effect mode, which was preferred in this study. Since the samples of two studies were large and thus may have increased the heterogeneity, they were eliminated from the sensitivity analysis. When these studies were excluded singly or together, the sensitivity analysis still indicated that the results of the study were reliable and stable. The children who live in a fluorosis area have five times higher odds of developing a low IQ than those who live in a nonfluorosis area or in a slight fluorosis area.

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Keywords: Children's IQ; Fluoride exposure; Fluorosis in China; Intelligence quotient; Meta-analysis.

NEURAL CELL DAMAGE BY FLUORIDE

EFFECTS OF FLUORIDE ON DNA DAMAGE, S-PHASE CELL-CYCLE ARREST AND THE EXPRESSION OF NF-κB IN PRIMARY CULTURED RAT HIPPOCAMPAL NEURONS

The mechanisms underlying the neurotoxicity of fluorosis still remain obscure. To investigate DNA damage, cell-cycle distribution, and expression of nuclear factor kappa B (NF-κB) induced by fluoride, primary rat neurons were incubated with various concentrations (20, 40, and 80 mg NaF/L for 24 hr in vitro. The results showed that olive tail moments (OTMs) were significantly elevated an all fluoride-treated groups, while significant increases in the percentage of DNA in the tail were observed, respectively, at 40 and 80 mg NaF/L. An increase in the
proportion of cells in S-phase was observed in response to 40 and 80 mg NaF/L. Gene expression of NF-κB was also enhanced by fluoride treatment in a dose-dependent manner. The results indicated that fluoride could induce S-phase cell-cycle arrest, up-regulation of NF-κB, and DNA damage in primary rat hippocampal neurons.

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Keywords: DNA damage; Nuclear factor kappa B; Rat hippocampal neurons; S-phase cell-cycle arrest.

TOXIC EFFECTS IN ANIMALS

INFLUENCE OF FLUORIDE ON THE RAT KIDNEY ANTIOXIDANT SYSTEM: EFFECTS OF METHIONINE AND VITAMIN E

The aim of the study was to determine and compare the influence upon the rat kidney antioxidative system of vitamin E, and vitamin E in combination with methionine, under conditions of oxidative stress induced by NaF. The experiment was carried out on Wistar FL rats (adult males) that, for 35 days, were administered water, NaF, NaF with vitamin E, or vitamin E with methionine (doses: 10 mg NaF/kg of body mass/24 hr, 3 mg vitamin E/10 µL/rat/24 hr, 2 mg methionine/rat/24 hr). The influence of NaF and antioxidants upon the antioxidative system in the kidneys was examined by analyzing the concentration of malondialdehyde (MDA) and the activity of the most important antioxidative enzymes (SOD, total, and both its isoenzymes, GPX, GST, GR, and CAT). The results confirmed the adverse effect of NaF on the antioxidative system in rats (increase in the concentration of MDA, decreased activity of all antioxidative enzymes). The administration of vitamin E increased the activity of the enzymes with the exception of glutathione reductase (GR); it also reduced the processes of lipid peroxidation. Combined doses of vitamin E and methionine were most effective in inhibiting lipid peroxidation. The results confirmed the antioxidative properties of methionine.

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Keywords: Antioxidant system; Fluoride kidney effects; Methionine; Oxidative stress; Rat kidney; Vitamin E.
IN VITRO TOXIC EFFECTS

ROLE OF OXIDATIVE STRESS IN OSTEOBLASTS EXPOSED TO SODIUM FLUORIDE

This research involves an investigation of the relationship between oxidative stress and the viability of osteoblasts exposed to various concentrations of fluoride. Primary calvarial osteoblasts from neonatal Kunming mice were cultured and subcultured to the third generation. Osteoblasts were incubated with sodium fluoride (0, 0.5, 1, 2, 4, 8, 12, and 20 mg F⁻/L) for 24, 48, and 72 hr. Analysis with 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) showed significantly increased cell viability when the osteoblasts were exposed to low concentrations of fluoride (0.5 to about 2 mg F⁻/L) for 24 to 72 hr. Oxidative stress analysis showed that low concentrations of fluoride excited lipid peroxidation in osteoblasts and increased the activity of antioxidant enzymes in varying degrees. Changes in osteoblast viability in the low-dose fluoride groups were different from those in the high-dose fluoride groups; however, both low and high doses of fluoride stimulated oxidative stress in osteoblasts.

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Keywords: Antioxidant enzymes; Calvarial osteoblasts; Cell viability; Fluoride and bone; Lipid peroxidation; Mouse osteoblasts; Oxidative stress.

FLUORIDATION CONTROVERSY REVIEWED

SECOND THOUGHTS ABOUT FLUORIDE

Since the middle of the last century, a broad coalition of scientists from government and industry has urged adding fluoride to drinking water to protect teeth against decay. Opposing them were activists claiming that fluoridation was mass medication and thus violated civil liberties. The advocates carried the day by dismissing contrary evidence and, in part, by ridiculing opponents. Fluoridation spread to Canada, the UK, Australia, New Zealand and a few other countries. Now, the scientific attitude towards fluoridation may be starting to shift, in spite of the US Centers for Disease Control and Prevention’s listing of water fluoridation as one of the 10 greatest health achievements of the 20th century.

After more than two years reviewing and debating hundreds of studies, a committee of the National Research Council (NRC) released a 507-page report, which gave a tinge of legitimacy to some of the antifluoridationists longtime assertions. The report concluded that the Environmental Protection Agency’s current limit of 4 milligrams of fluoride per litre (mg/L) should be lowered because of health risks to humans. Exposure to fluoride causes dental fluorosis in children, which is considered only a cosmetic effect, and increases the risk of skeletal fluorosis in adults. The NRC report noted the possibility of more serious problems including bone cancer and damage to the brain and thyroid gland.

For the past 16 years, Stephen M. Levy of the University of Iowa College of
Dentistry has conducted a fluoride study in which 700 children were tracked over this period to tease out subtle effects of fluoridation that may have been previously overlooked. He is also leading an extensive effort to measure fluoride concentrations in thousands of products. Dr Levy still supports fluoridation but wonders if children are being overexposed.

Dr Elise B Bassin of the Harvard School of Dental Medicine produced a report which concluded that fluoride is a risk factor for osteosarcoma among boys (the results were ambiguous for girls). This report appeared in 2006 in the journal Cancer Causes and Controls. In the same issue, her dissertation advisor at Harvard, Chester Douglass, wrote a commentary warning readers to be “especially cautious” in interpreting her findings because, he said, better data, still unpublished, contradict them. Antifluoridationists and some environmental groups rushed to Bassin’s defense, demanding that Harvard investigate Douglass for allegedly misrepresenting Bassin’s work and for having a conflict of interest because he is editor-in-chief of a newsletter for dentists funded by Colgate. The university investigation completed in 2006, concluded that there was no misconduct or conflict of interest.

Phyllis Mullenix of the Forsyth Institute in Boston reported in the early 1990’s that experiments on lab rats showed that sodium fluoride can accumulate in brain tissue and affect animal behavior. Her research was later published in Neurotoxicity and Teratology but was attacked by other scientists. However, epidemiological studies in China have found an associated high fluoride exposure with lower IQ.

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**Keywords:** Adverse health effects; Endorsements questioned; Fluoridation controversy; Fluoride and teeth.
**Source:** Sci Am 2008 Jan;74-81.

**WATER FLUORIDATION IN CANADA**

**CANADIAN WATER PROVIDERS CEASING ARTIFICIAL FLUORIDATION**

On January 24, 2008, a delegation from People for Safe Drinking Water convinced the Niagara Regional Council not to initiate fluoridation at its six regional water plants and also to discontinue fluoridation where it existed. In March 2008, the Thunder Bay Council deferred deciding to fluoridate Bare Point until action on an Environmental Bill of Rights concerning the addition of inorganic fluorides to drinking water had been completed. On April 1, 2008, after an extensive review of research pro and con, the Quebec City Council voted to end fluoridation. On April 14, after hearing evidence presented separately by Dr Peter Cooney, Chief Dental Officer for Canada, and by Professor Paul Connett of the Fluoride Action Network, NY, residents of Dryden, Ontario, voted 87% against
adding fluoride to their drinking water.

Reasons for these decisions are multiple, but foremost among them are concerns that excessive fluoride intake is linked to increased thyroid dysfunction, hip fractures, dental fluorosis, and other adverse health effects. Moreover, the long-held belief that incorporation of fluoride from ingestion into tooth enamel during tooth formation has a significant anti-caries effect has now been largely and officially discarded in favor of the view that a topical action of fluoride is primarily responsible for preventing dental caries and promoting enamel remineralization. However, even that argument is open to question, since “fluoridation no longer appears to reduce dental expenses or [tooth] decay. . . . [and] evidence for the effectiveness of fluoridation cannot be demonstrated. . . . studies have been done where fluoridation has been stopped and a cessation of fluoridation does not result in an increase in tooth decay.” (italics in original) This conclusion is also supported by data collected by the World Health Organization for tooth decay trends among 12-year-old children. Beginning in the 1960s and 1970s their dental caries rates declined about equally into the present decade of the 21st century in nonfluoridated as well as largely fluoridated countries.

A further concern is that raw hydrofluosilicic acid (HFSA), the most widely used fluoridating agent, is a scrubbing tower by-product from the production of phosphate fertilizer and is contaminated with varying amounts of lead, arsenic, cadmium, mercury, and radionuclides. When HFSA with its known toxins is added to a high-quality water supply, “the finished drinking water is degraded from its treated state. HFSA does nothing to enhance, purify, or improve the [safety] quality of drinking water.”

Finally, the dose vs. concentration aspect remains of paramount importance. As is well known, water intake varies greatly among individuals. Infants, athletes, outside workers, soldiers, diabetics, and kidney patients “each consume more water than normal, [and] therefore they receive more mg of fluoride per kg of body weight.”

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