

HEALTH/BIOLOGICAL EFFECTS**Effect of experimental fluorosis on the surface topography of developing enamel crystals**

Dental fluorosis is an increasing problem, yet the precise mechanism by which fluoride exerts its effects remains obscure. In the present study, we have used atomic force microscopy to image and quantitate surface features of enamel crystals isolated from specific developmental stages of fluorotic and control rat incisors. The results showed a significant decrease in crystal surface roughness with development in control tissue. Crystals from fluorotic tissue were significantly rougher than controls at all stages of development, did not decrease in roughness during the later stages of their development and had many morphological abnormalities. These data clearly demonstrate an effect for fluoride on enamel crystal surfaces which could reflect changes in the nature and distribution of growth sites and/or in mineral-matrix interactions. These would be expected to affect crystal growth during maturation, resulting in the characteristic porous appearance of fluorotic lesions in mature teeth.

Authors: Kirkham J, Brookes SJ, Zhang J, Wood SR, Shore RC, Smith DA, Wallwork ML, Robinson C.

For Correspondence: Division of Oral Biology, Leeds Dental Institute, University of Leeds, UK.

Keywords: Dental fluorosis, Enamel crystals.

Source: Caries Res 2001 Jan;35(1):50-56.

Fluoride for the treatment of postmenopausal osteoporotic fractures: a meta-analysis

We conducted an effectiveness meta-analysis to determine the efficacy of fluoride therapy on bone loss, vertebral and nonvertebral fractures and side effects in postmenopausal women. A literature search was conducted on *Medline*, *Current Contents*, and the *Cochrane Controlled Trial Registry*. Two independent reviewers selected randomized controlled trials which met predetermined inclusion criteria. They independently extracted data using predetermined forms and assessed the methodologic quality of the trials using a validated scale. For dichotomous outcomes, the relative risk (RR) was calculated, and for continuous outcomes, the weighted mean difference (WMD) of percentage change from baseline was calculated. Where heterogeneity existed (determined by a chi-square test) a random effects model was used.

Eleven studies (1429 subjects) met the inclusion criteria. The increase in lumbar spine bone mineral density (BMD) was found to be higher in the treatment group than in the control group with a WMD 8.1% (95% CI: 7.15, 9.09) after 2 years of treatment and 16.1% (95% CI: 14.65, 17.5) after 4 years. The RR for new vertebral fractures was not significant at 2 years [0.87 (95% CI: 0.51, 1.46)] or at 4 years [0.9 (95% CI: 0.71, 1.14)]. The RR for new nonvertebral fractures was not significant at 2 years [1.2 (95% CI: 0.68, 2.10)] but was

increased at 4 years in the treated group [1.85 (95% CI: 1.36, 2.50)], especially if used at high doses and in a non-slow-release form. The RR for gastrointestinal side effects was not significant at 2 years [2.18 (95% CI: 0.86, 1.21)] but was increased at 4 years in the treated group [2.18 (95% CI: 1.69, 4.57)], especially if fluoride was used at high doses and in a non-slow-release form. The number of withdrawals and dropouts was not different between treated and control groups at 2 and 4 years. Thus, although fluoride has an ability to increase bone mineral density at the lumbar spine, it does not result in a reduction in vertebral fractures. Increasing the dose of fluoride increases the risk of nonvertebral fractures and gastrointestinal side effects without any effect on the vertebral fracture rate.

Authors: Haguenaer D, Welch V, Shea B, Tugwell P, Adachi JD, Wells G.

For Correspondence: Clinical Epidemiology Unit, University of Ottawa, Ottawa Hospital, Ottawa, Ontario, Canada.

Keywords: Bone fractures, Bone mineral density, Fluoride, Osteoporosis.

Source: *Osteoporos Int* 2000;11(9):727-38.

Concomitant sickle cell disease and skeletal fluorosis

Skeletal fluorosis typically manifests as a diffuse increase in bone density, whereas avascular necrosis of the epiphyses and diaphyseal marrow are the main skeletal manifestations of sickle cell disease. The diagnostic and therapeutic challenges raised when both disorders are present are illustrated by two cases in Senegalese patients from an area characterized by high fluoride contents in the water and soil. Both had SS sickle cell disease. Skeletal fluorosis was diagnosed during evaluation for avascular necrosis in one patient and in the wake of septic arthritis in the other. Femoral head necrosis is difficult to identify in a patient with skeletal fluorosis. The bone lesions due to sickle cell disease and those due to fluorosis can mimic other bone diseases, most notably metastases. The combination of sickle cell disease and fluorosis results in significant medullary canal narrowing due to cortical thickening and to accumulation of necrotic bone. When performing hip replacement surgery, careful reaming of the medullary canal may reduce the risk of iatrogenic femoral fracture and inappropriate stem placement.

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Keywords: Skeletal fluorosis, Sickle cell disease.

Source: *Joint Bone Spine* 2000;67(5):478-80.

Cytotoxicity of fluoride on human pulp cell cultures in vitro

Objectives: Numerous studies have revealed that conventional glass-ionomer cements might release fluoride into an aqueous environment. The objective of this study was to examine the effects of fluoride on human pulp cells in vitro.

Study Design: H33258 fluorescence, cell proliferation, protein synthesis, and mitochondrial activity assay were used to investigate the pathobiological effects of fluoride on cultured human pulp cells.

Results: Fluoride was found to be a cytotoxic agent to cultured human pulp cells by inhibiting cell growth, proliferation, mitochondrial activity, and protein synthesis.

Conclusions: Fluoride release has significant potential for pulpal toxicity.

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Keywords: Dental pulp cells, Fluoride toxicity.

Source: Oral Surg Oral Med Oral Path Oral Radiol Endod 2001 Feb;91(2):230-4.

Varied ecological environment and fluorosis in Tibetan children in the nature reserve of Mount Qomolangma

To determine the extent of brick tea consumption fluorosis in children living at elevations of 2000 and 4300 m, 519 children aged 8-15 years living in Xiege'er Town at 4300 m and Zhangmu Town at 2000 m were examined for dental fluorosis, their urinary fluoride concentration was determined, their dietary structure investigated, and the fluoride concentrations of various foods, freshwaters, soils, and fuels determined. Fifteen Tibetan families living in these two areas of the nature reserve of Mount Qomolangma were studied according to UNEP, FAO, and WHO guidelines for the study of dietary intake of chemical contaminants, Horowitz's classification and examination of dental fluorosis, and Dean's dental fluorosis index. The results demonstrated that dental fluorosis in Tibetan children living at an elevation of 2000 m was significantly lower than that of children at 4300 m ($P < 0.01$). Higher elevation can worsen the extent of fluorosis, leading to retention of fluoride in tissues as a result of hypoxia, but fluorosis can also be associated with the deterioration of the ecological environment at high elevation and a low-level economy. Beverages and foods mixed with brick tea water are responsible for the dental fluorosis in the children.

Authors: Cao J, Zhao Y, Liu J, Xirao R, Danzeng S.

For Correspondence: Tea and Health Laboratory, Hunan Medical University, Changsha, Hunan, 410078, Peoples Republic of China.

Keywords: Brick tea, Dental fluorosis, Tibet.

Source: Ecotoxicol Environ Saf 2001 Jan;48(1):62-5.

Low birth weight and dental fluorosis: is there an association?

Objective: The association between low birth weight and dental fluorosis was explored in a cross-sectional study to explain the higher prevalence of dental fluorosis among African-American children.

Methods: Birth weight data on 960 children were obtained from the New York State Birth Registry. Data on race, fluoride exposure, sociodemographic characteristics, and dental fluorosis were available from a cross-sectional study conducted in Newburgh and Kingston. Associations among birth weight, race, and fluoride exposure from fluoridated water, regular use of supplements, brushing before the age of 2 years, and subject-level dental fluorosis were explored using logistic regression procedures.

Results: The regression coefficients for the main effects and the two-way interaction effects associated with low birth weight, race, and fluoride exposure were not statistically significant. Even after controlling for low birth weight and fluoride exposure, African-American children had a statistically significant higher odds ratio (OR = 2.0). An analysis of the data limited to mandibular permanent first molars showed similar effects, except for evidence of effect modification in low birth weight children exposed to fluoride supplements.

Conclusions: Lower birth weight did not explain the higher prevalence of dental fluorosis observed among African-American children.

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Keywords: Birth weight, Dental fluorosis.

Source: J Public Health Dent 2000 Summer;60(3):167-71.

Patterns of dental caries following the cessation of water fluoridation

Objectives: To compare prevalence and incidence of caries between fluoridation-ended and still-fluoridated communities in British Columbia, Canada, from a baseline survey and after three years.

Methods: At the baseline (1993/4 academic year) and follow-up (1996/7) surveys, children were examined at their schools. Data were collected on snacking, oral hygiene, exposure to fluoride technologies, and socio-economic level. These variables were used together with D1D2MFS indices in multiple regression models.

Results: The prevalence of caries (assessed in 5,927 children, grades 2, 3, 8, 9) decreased over time in the fluoridation-ended community while remaining unchanged in the fluoridated community. While numbers of filled surfaces did not vary between surveys, sealed surfaces increased at both study sites. Caries incidence (assessed in 2,994 life-long residents, grades 5, 6, 11, 12) expressed in terms of D1D2MFS was not different between the still-fluoridating and fluoridation-ended communities. There were, however, differences in caries experienced when D1D2MFS components and surfaces at risk were investigated in detail. Regression models did not identify specific variables markedly affecting changes in the incidence of dental decay.

Conclusions: Our results suggest a complicated pattern of disease following cessation of fluoridation. Multiple sources of fluoride besides water fluoridation have made it more difficult to detect changes in the epidemiological profile of a population with generally low caries experience, and living in an affluent setting with widely accessible dental services. There are, however, subtle differences in caries and caries treatment experience between children living in fluoridated and fluoridation-ended areas.

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Keywords: Dental caries, Fluoridation cessation.

Source: Community Dent Oral Epidemiol 2001 Feb;29(1):37-47.

Fluoride intake and prevalence of dental fluorosis: trends in fluoride intake with special attention to infants.

Background: Although the predominant beneficial effect of fluoride occurs locally in the mouth, the adverse effect, dental fluorosis, occurs by the systemic route. The caries attack rate in industrialized countries, including the United States and Canada, has decreased dramatically over the past 40 years. However, the prevalence of dental fluorosis in the United States has increased during the last 30 years both in communities with fluoridated water and in communities with nonfluoridated water. Dental fluorosis is closely associated with fluoride intake during the period of tooth development.

Methods: We reviewed the major changes in infant feeding practices that have occurred since 1930 and the changes in fluoride intakes by infants and young children associated with changes in feeding practices.

Results and conclusions: Based on this review, we conclude that fluoride intakes of infants and children have shown a rather steady increase since 1930, are likely to continue to increase, and will be associated with further increase in the prevalence of enamel fluorosis unless intervention measures are instituted.

Recommendations: We believe the most important measures that should be undertaken are (1) use, when feasible, of water low in fluoride for dilution of infant formulas; (2) adult supervision of toothbrushing by children younger than 5 years of age; and (3) changes in recommendations for administration of fluoride supplements so that such supplements are not given to infants and more stringent criteria are applied for administration to children.

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Keywords: Children, Dental fluorosis, Fluoride in food and dental, Fluoride in water.

Source: J Public Health Dent 2000 Summer;60(3):131-9.

Caries trends 1992-1998 in two low-fluoride Finnish towns formerly with and without fluoridation

Water fluoridation in Kuopio, Finland, was stopped at the end of 1992. In our previous study, no increase in caries was found in Kuopio 3 years after the discontinuation of water fluoridation. The aim of the present study was to further observe the occurrence and distribution of caries in Kuopio and Jyvaskyla, which was used as the reference town for Kuopio. In 1992, 1995 and 1998 independent random samples of all children aged 3, 6, 9, 12 and 15 years were drawn in Kuopio and Jyvaskyla. The total numbers of subjects examined were 688, 1,484 and 1,530 in 1992, 1995 and 1998, respectively.

Calibrated dentists registered caries clinically and radiographically. No indication of increasing caries could be found in the previously fluoridated town during 1992-1998. In both towns the mean dmfs and DMFS values either decreased or remained about the same during the observation period. When all study years and both towns were pooled, 25% of the 12- and 15-year-olds with the highest DMFS counts accounted for 79 and 67%, respectively, of all affected surfaces. The mean numbers of fluoride varnish and sealant applications had markedly decreased in 1993-1998 compared to 1990-1992. The fact that no increase in caries was found in Kuopio despite discontinuation of water fluoridation and decrease in preventive procedures suggests that not all of these measures were necessary for each child.

Authors: Seppa L, Karkkainen S, Hausen H.

For Correspondence: Institute of Dentistry, University of Oulu, Finland.

Keywords: Defluoridation, Dental caries, Finland.

Source: Caries Res 2000 Nov;34(6):462-8.

The prevalence of dental caries and fluorosis in Japanese communities with up to 1.4 ppm of naturally occurring fluoride

Objectives: The purpose of this study was to determine the relationship between the concentration of fluoride in drinking water and the prevalence of dental caries and fluorosis in seven Japanese communities with different concentrations of fluoride occurring naturally in the drinking water.

Methods: A total of 1,060 10- to 12-year-old lifetime residents were examined to determine the prevalence of dental caries and fluorosis in communities with trace amounts to 1.4 ppm fluoride in the drinking water in 1987. Systemic fluorides (drops or tablets) have never been available in Japan and the market share of fluoride-containing toothpaste was 12 percent at the time of the study.

Results: The prevalence of dental caries was inversely related and the prevalence of fluorosis was directly related to the concentration of fluoride in the drinking water. The mean DMFS in the communities with 0.8 to 1.4 ppm fluoride was 53.9 percent to 62.4 percent lower than that in communities with negligible amounts of fluoride. Multivariate analysis showed that water fluoride

level was the strongest factor influencing DMFS scores. The prevalence of fluorosis ranged from 1.7 percent to 15.4 percent, and the increase in fluorosis with increasing fluoride exposure was limited entirely to the milder forms.

Conclusions: The findings of this study conducted in 1987 in Japan parallel those reported by Dean *et al* in the early 1940s.

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Keywords: Dental caries, Dental fluorosis, Fluoride in water, Japan.

Source: J Public Health Dent 2000 Summer;60(3):147-53.

DIETARY FLUORIDE

The bio-availability of fluoride from black tea

Objectives: To investigate the oral retention of fluoride from tea and its association with the tooth surface and acquired pellicle.

Methods: Oral retention of fluoride after rinsing *in vivo* was assessed from expectorated samples with an ion specific electrode methodology. Interaction of fluoride with the tooth surface and acquired pellicle was examined in situ with enamel blocks mounted on partial removable appliances. In vitro models were used to examine fluoride binding to enamel particles.

Results: Thirty four percent of the fluoride was retained in the oral cavity after rinsing with tea. Differences in retention at the tooth surface in the presence and absence of an acquired pellicle were not statistically significant at incisor or molar sites. Fluoride from tea showed strong binding to enamel particles, which was only partially dissociated by solutions of ionic strength considerably greater than that of saliva. Binding studies demonstrated strong avidity of enamel for tea and salivary pellicle components.

Conclusions: This study has demonstrated that tea can provide an effective vehicle for fluoride delivery to the oral cavity where it may interact with the oral tissues and their surface integuments. This may lead to local topical effects of the ingested fluoride as well as systemic effects following oral and gastrointestinal absorption.

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Keywords: Fluoride in food, Tea.

Source: J Dent 2001 Jan;29(1):15-21.

Fluoride in water consumed by children in remote areas of Thailand

The objective of this study was to analyze fluoride content in water for drinking and for use in remote areas of Thailand.

Water was sampled from schools and villages along the border by Multiple Stratified Cluster Random Sampling. Fluoride levels of 214 water samples from 48 schools and 48 villages were assessed in triplicate by fluoride ion electrode. The fluoride content in different regions and types of water were statistically analyzed by Kruskal-Wallis test at a significance level of 0.05. Results showed that fluoride in drinking water and water for use from the schools and villages were 0.01-0.37 ppm, 0.01-0.19 ppm, 0.01-0.87 ppm and 0.01-0.92 ppm, respectively. There was no difference in fluoride content in drinking water from various regions ($p=0.23$). However, there was a statistical difference in fluoride level in water for use ($p=0.04$, $p=0.01$) in various regions. The highest fluoride content was found in samples from the central and eastern region (0.19 ± 0.24 ppm and 0.29 ± 0.28 ppm respectively). When comparing types of water, *ie* ground water, surface water and rain water, there were differences in fluoride content ($p=0.0$). Underground water had the highest fluoride content (0.31 ± 0.23 ppm).

Authors: Chuckpaiwong S, Nakornchai S, Surarit R, Soo-ampon S, Kasetsuwan R.
For Correspondence: Department of Hospital Dentistry, Faculty of Dentistry, Mahidol University, Bangkok, Thailand.

Keywords: Fluoride in water, Thailand.

Source: Southeast Asian J Trop Med Public Health 2000 Jun;31(2):319-24.

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Editor's note: In keeping with the purposes of the International Society for Fluoride Research, the following edited abstracts are offered to our readers to provide accounts of recent findings in fluoride research that appear to be worth a wider audience than they would ordinarily have.

Clinical study of the effect of high fluoride on the function of the pancreatic islet's B cells

Objective: Study the effect of excessive fluoride intake on the function of the pancreatic islet's B cells.

Methods: Perform x-ray, determine the F^- in the urine, make GTT, insulin and C-peptide releasing test in the serum, and analyse the drinking water quality of the exposed group and the control group.

Results: The F^- in drinking water and the geometrical mean of the F^- in the urine of the people of the exposed group were higher than those of the control group. The fasting blood glucose concentration and the peak value after oral glucose in the exposed group were higher than in the control group. The peak value was found later in the exposed group than in the control group. The detectable rate of diabetes and IGT in the exposed group was higher than in the control group. The blood-insulin and the C-peptide in the exposed group were lower than in the control group, while the peak values after oral glucose occurred later and were lower in the exposed group than in the control group.

Conclusions: Excessive fluoride can do much harm to the function of the pancreatic islet's B cells, and the effects change with the degree of fluorosis.

Authors: Xie Y-P, Ge X-J, Jiang Y-T, et al.

For Correspondence: Gaomi People's Hospital, Shandong Province, Gaomi 261500, China.

Keywords: Diabetes, Fluoride toxicity, Pancreas.

Source: Chinese Journal of Endemiology 2000;19(2):84-6.

Effect of fluoride on the ultrastructure of adeno-epithelial cells of human fetus

Objective: Investigate damage mechanism of fluoride on cells.

Methods: The livers, adrenal glands, and thyroids from human fetuses from an endemic fluorosis area were used to investigate the effects of fluoride on ultrastructure of the adeno-epithelial cells. In addition, fetal urinary fluoride was determined. The results showed that the urinary fluoride levels of fetuses from the endemic region were markedly increased in comparison with the levels of fetuses from the non-endemic region.

Results: Electron microscopy revealed an overall decrease in the number of microvilli and a shortening. There was mitochondrial swelling and dilation of

the rough endoplasmic reticulum (RER). Nucleoprotein on the RER had fallen off, and the nuclear membrane manifested cystoid dilation.

Conclusions: The results suggest that increased fluoride levels have multiple effects on the adeno-epithelia. The increased fluoride concentration may not only damage the cellular ultrastructures, but also disturb the normal physiological function of the adeno-epithelia.

Author: Yu Y-N.

For Correspondence: Department of Pathology, Guiyang Medical College, China.

Keywords: Adrenal gland, Fluoride toxicity, Liver, Thyroid gland, Ultrastructural changes.

Source: Chinese Journal of Endemiology 2000;19(2):81-3.

Effects of high fluoride drinking water on the cerebral functions of mice

Objective: To study the effects of high fluoride concentration in drinking water on the cerebral functions of mice.

Methods: Learning and memory abilities of high-fluoride exposed and control groups of mice were measured by behavior-toxicological test (Shuttle box Test), and the cholinesterase (ChE) activity in brain tissue homogenate of the mice was determined.

Results: Learning and memory abilities of high-fluoride exposed groups were significantly lower than that of the control group, while the brain ChE activities of high-fluoride exposed groups were significantly higher.

Conclusions: High fluoride concentration in drinking water can decrease the cerebral functions of mice. Fluoride is a neurotoxicant.

Authors: Sun Z-R, Liu F-Z, Wu L-N, et al.

For Correspondence: Department of Environmental Health, Tianjin Medical University, Tianjin 300070, China.

Keywords: Cholinesterase activity, Fluoride in water, Mouse study, Neurotoxicity.

Source: Chinese Journal of Endemiology 2000;19(4):262-3.

Influence of experimental fluorosis on fatty acid composition of phospholipid in rat liver and kidney

Objective: To study the influence of experimental fluorosis on fatty acid composition of phospholipid in rat liver and kidney.

Methods: Wistar rats were fed with various amounts of fluoride in drinking water for seven months to produce the animal model with chronic fluorosis. Phospholipid in rat liver and kidney was extracted by the improved Falch method, and fatty acid compositions of this lipid were analysed using gas chromatography.

Results: The results showed that all animals fed with high amounts of fluoride suffered from chronic fluorosis, manifested by dental fluorosis, an increase of

fluoride level in urine, and a decrease of protein content in liver and kidney as compared with controls. The abnormal composition of fatty acids from phospholipids in liver and kidney was observed in the rats with chronic fluorosis. The proportion of unsaturated fatty acids was decreased and the saturated fatty acids increased. The species of unsaturated fatty acids influenced by fluorosis were 20:4 (arachnidonic acid) and 22:6.

Conclusions: The study suggests that high amounts of fluoride can induce modification of fatty acid compositions of phospholipid in liver and kidney, which might be the result from oxidative stress and an increased level of lipid peroxidation.

Authors: Shao Q-L, Xiao K-Q, Wang Y-N, et al.

For Correspondence: Guiyang Medical College, Guiyang 550004, China.

Keywords: Fatty acid, Fluoride toxicity, Phospholipid, Rat Liver, Rat kidney.

Source: Chinese Journal of Endemiology 2000;19(1):22-5.

Study of the free radical and morphological changes in the bone of rats with chronic fluorosis

Objective: In order to investigate free radical and morphologic bone change in rats with chronic fluorosis, three groups of rats were used.

Methods: The free radical (FR) bone content was determined by the electronic spin resonance technique (ESR). Superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px) activities were tested at the same time. Malonaldehydic acid (MDA) and morphological bone changes were also assessed.

Results: Results showed urinary fluoride levels were increased, erythrocyte SOD and GSH-Px activities were markedly elevated, and plasma MDA levels were markedly decreased in rats with fluorosis in comparison with a normal control group of rats. Meanwhile, in the fluoride-exposed rats with markedly elevated FR levels there was a thinning of bone cortices and trabeculae. The number of osteocytes was also reduced. However, the SOD and GSH-Px activities were within normal ranges, FR and MDA contents were also within normal limits, and no pathological changes were found in this fluoride-exposed group treated with Gypenosides-Danshen Composite.

Conclusions: Results suggest excessive fluoride levels in the bodies of the rats with chronic fluorosis induce an imbalance in the anti-oxidase system and result in bone changes along with increased activities of SOD and GSH-Px and FR. MDA contents are increased. Quite possibly FR changes in the body may be a key link in fluorosis pathogenesis.

Authors: Yu Y-N, Liu J-J, Wang S-L, et al.

For Correspondence: Department of Pathology, Guiyang Medical College, Guiyang 550004, China.

Keywords: Bone pathology, Enzyme changes, Fluoride toxicity, Free radicals.

Source: Chinese Journal of Endemiology 2000;19(5):337-9.

Hepatocyte apoptosis in fluorosis rats

Objective: To study the influence of fluoride and F + Ca on the hepatocyte apoptosis in rats.

Methods: The hepatocyte apoptosis was investigated by using flow cytometry, and the GSH-px activity was measured at the same time.

Results: The percentage of hepatocyte apoptosis bodies was higher in the group with added fluoride ($P < 0.01-0.05$) and much higher in the group with added F+Ca ($P < 0.01$) than that of control; the GSH-px activity was reduced in rats fed with F or F+Ca.

Conclusions: Hepatocyte apoptosis can be induced by fluoride, and the change of GSH-px may play an important role in the mechanism of hepatocyte apoptosis.

Authors: Jing L, Shao Z, Ren L, et al.

For Correspondence: Institute of Endemic Diseases in Norman Bethune University of Medical Sciences, Changchun 130021, China

Keywords: Apoptosis, Calcium, Fluoride toxicity, Rat liver.

Source: Chinese Journal of Endemiology 1999;18(2).

Study of the mechanism of neurone apoptosis in rats from the chronic fluorosis

Objective: Study the mechanism of action chronic fluorosis in neurones.

Methods: Terminal deoxyribo-nucleotide transferase-mediated dUTP-biotin nick end labeling (TUNEL) and flow cytometry (FCM) were used to observe changes of apoptosis in cerebral cells in chronic fluorosis in rats.

Results: TUNEL results show non-random expression of DAB positive stain apoptosis cells which appear only in the hippocampus CA4 region. FCM results show that the percentage of DNA fragmentation increased markedly in the cerebral neurones of rats with chronic fluorosis but not in different cerebral regions.

Conclusions: There is a tendency for neurone apoptosis in chronic fluorosis in rats. It is most evident with changes in pathology. It is not likely that only one form of neurone damage exist in the process of chronic fluorosis. There are recessive changes and apoptosis in the process at the same time.

Authors: Lu X-H, Li G-S, Sun B.

For Correspondence: Institute of Endemic Diseases in Norman Bethune University of Medical Sciences, Changchun 130021, China.

Keywords: Apoptosis, Brain, Fluoride toxicity, Neurotoxicity, Rat study.

Source: Chinese Journal of Endemiology 2000;19(2):96-8.

Experimental study on effects of selenium in rats with fluorosis

Objective: Study on effects of selenium (Se) on fluorine (F), anti-oxidation enzymes, and lipid metabolism in rats with fluorosis.

Methods: A fluorosis study was made on Wistar rats for 10 months. The rats were divided into 4 groups: (1) high F water (2.63 mmol F/L in the drinking water); (2) high F water and Se supplementation (2.0 mg Se/kg) in the fodder; (3) normal water; (4) normal water and Se. The F content in urine was determined at appropriate intervals, as was the F in the bones, liver, kidneys, and serum. The activities of glutathione peroxidase (GSH-px) and superoxide dismutase (SOD) in erythrocyte, liver and kidneys, the contents of total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C) in serum were determined.

Results: There was an increase of urine F and a decrease of liver, kidney, and bone F. Anti-oxidation enzymes and lipid metabolism improved in the combined high F and Se group compared with the high F group. In the normal water and Se group the function of promoting excretion of F and decreasing tissue and bone F had the advantage that the level of anti-oxidation enzyme activity and lipids approached those of the control group.

Conclusions: Se in the range of certain concentration had the role of excreting high F, adjusting disorder of free radicals and lipid metabolism, and prompting recovery of rats from fluorosis.

Authors: Bian J, Liu Y, Yang X, et al.

For Correspondence: Shandong Institute for prevention and Treatment of Endemic Disease, Jinan 250014, China.

Keywords: Antioxidases, Fluoride toxicity, Enzyme changes, Rat study, Selenium.

Source: Chinese Journal of Endemiology 1999.

The effects of high fluoride on micronucleus rate in humans and mice

Objective: The human body and the mice were regarded as suitable subjects to study the effects of high-fluoride on micronucleus rate in mammalian animals.

Methods: In a test on the human body, the micronucleus rate of 51 adults from a high-fluoride area was compared with the micronucleus rate of 24 adults from a low-fluoride area. In a test on mice, the experimental group drank fluoride water, and the control group drank tap water. Differences were examined for significance by the chi-squared test.

Results: The micronucleus rate of adults from the high-fluoride area was higher than that of adults in the low-fluoride area, and the difference was significant ($P < 0.05$). The micronucleus rate of mice drinking high-fluoride water was higher than that of the control group, and the difference was also significant ($P < 0.05$).

Conclusions: High-fluoride intake increases the micronucleus rate in mammals, and can damage chromosomes. Fluoride may therefore be mutagenic.

Authors: Li J, Zhou H-L, Yang Q, et al.

Source: Chinese Journal of Endemiology 2000; 19(5):340-1.

Effects of fluoride on activities of nitric oxide synthase in rat brain

Objective: To study the mechanism of neurotoxicity of fluoride.

Methods: The activities of nitric oxide synthase (NOS) from rat brain were determined by chemiluminescent method.

Results: The activities of NOS from rats exposed to sodium fluoride (NaF) were significantly higher than those of control rats. When NaF was added to NOS, an increase in activities of NOS was observed. This increase can be inhibited by NG-NitioL-L-Arginine, an inhibitor of nitric oxide synthase.

Conclusions: Fluoride can enhance the activities of NOS in rat brain.

Authors: Xu S, Shu B, Chen Z.

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Keywords: Enzyme changes, Fluoride toxicity, Neurotoxicity, Rat study.

Source: Chinese Journal of Endemiology 1999.

Dynamically observed skeletal X-ray in rats with chronic fluorosis and effects of selenium

Objective: To observe trend of skeletal radiography in rats with chronic fluorosis and effects of selenium.

Methods: Two groups of Wistar rats were fed with normal fodder and a high concentration of NaF in water (1.58 and 2.63 mmol F/L) and two groups with selenite fodder (2.0 mg Se/kg) and high F for 14 months. The rats were photographed bimonthly by means of radiography with molybdenum target tubes for a total of 6 times during 14 months, during which the F contents of urine, serum, and bone were determined.

Results: Urine, serum, and bone F in rats with fluorosis increased. Concerning bone X-ray changes, abnormalities were observed first in pelvis, then in lumbar vertebrae, finally in thoracic and pectoral limbs. Early skeletal fluorosis was found after 8 months. There was a positive correlation between concentration of F in drinking water and the degree of skeletal fluorosis and of abnormal bone structure. After supplementation with Se, serum and bone F decreased. Abnormal bone structure and skeletal fluorosis were also reduced.

Conclusions: The pelvis could be referred as essential observation section by radiography, and skeletal fluorosis appeared in the middle and late period of fluorosis. Certain concentrations of Se can antagonize the effects of high F intake, delaying and decreasing the occurrence of skeletal fluorosis in rats.

Authors: Bian J-C, Li H-X, Liu Y, et al.

For Correspondence: Shandong Institute for Prevention and Treatment of Endemic Disease, Jinan 250014, China.

Keywords: Fluoride toxicity, Rat study, Selenium, Skeletal fluorosis.

Source: Chinese Journal of Endemiology 2000;19(4);260-1.