HEALTH/BIOLOGICAL EFFECTS

Evidence suggesting that high intake of fluoride provokes nephrolithiasis in tribal populations

The present study was designed to evaluate the role of fluoride in urolithiasis in humans. Two areas were selected for this purpose, a fluoride endemic area (EA) and a fluoride non-endemic area (NEA). The prevalence of uroliathiasis was 4.6 times higher in EA than in NEA. Furthermore, the prevalence was almost double in subjects with fluorosis than without fluorosis in the endemic area. No relationship was observed between urolithiasis and the duration of fluorosis. The fluoride levels in drinking water ranged from 3.5 to 4.9 ppm in EA and subjects from this area excreted more fluoride. A comparison of normal subjects (NS) from EA and NEA revealed that endemic subjects tend to have slightly higher mean serum thiobarbituric acid reactive substance (TBAR) levels and excrete more oxalate and fluoride than their non-endemic counterparts. The urinary stone formers (SF) from the two areas showed a similar tendency, though again the difference was not significant. Citrate excretion in SF was almost normal in the EA, but NEA SF had significantly lower excretion levels. Urinary stones from endemic patients had higher fluoride, oxalate and calcium levels than those from non-endemic patients. In vitro studies suggested that fluoride did not influence the heterogeneous mineralization of calcium oxalate. In conclusion, the data suggest that fluoride in vivo may behave as a mild promoter of urinary stone formation by (a) excretion of insoluble calcium fluoride, (b) increasing oxalate excretion and (c) mildly increasing the oxidative burden.

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Keywords: Fluoride, Nephrolithiasis, Urolithiasis.
Source: Urol Res 2001 Aug;29(4):238-44.

Dental fluorosis and caries experience in relation to three different drinking water fluoride levels in South Africa

Objectives: The purpose of this study was to determine the relationship between caries experience, degree of fluorosis and different concentrations of fluoride in the drinking water of children.

Sample and methods: The study included 282 children aged 10-15 years, who lived continuously since birth in three different naturally fluoridated areas (Leeu Gamka, 3.0; Kuboe 0.48 and Sanddrif 0.19 ppm F), with virtually no dental care or any fluoride therapy The teeth of the children were examined for

caries using the DMFT index according to the WHO criteria and for fluorosis, using Dean's criteria according to the WHO guidelines.

Results: The prevalence of fluorosis (scores 2, 3, 4, and 5) among the school children was 47% in Sanddrif, 50% in Kuboes and 95% in Leeu Gamka. Almost half the children in the two low fluoride areas had no fluorosis (scores 0 and 1), whereas only 5% in Leeu Gamka had no fluorosis. Of the children in Sanddrif, 42.5% had very mild/mild (scores 2 and 3) fluorosis, 44.3% in Kuboes and 34.1% in Leeu Gamka. Except for one individual in Kuboes, severe fluorosis (score 5) was only observed in the high fluoride area in 30% of the children. According to the Bonferroni adaptation for multiple comparisons, the degree of fluorosis in Leeu Gamka differed significantly from both those of Sanddrif and Kuboes. The mean DMFT for the children in Sanddrif and Kuboe was similar (1.64 ± 0.30 and 1.54 ± 0.24, respectively) but the caries experience of Leeu Gamka (1.98 ± 0.22) was significantly higher ($P < 0.05$) than that of both the other two areas. A strong positive correlation ($P < 0.05$) was found between the caries experience and the fluorosis scores of children in the high fluoride area (Leeu Gamka) but no correlation could be found in the other two areas. Significantly ($P < 0.01$) more children had decayed teeth in the high F area (Leeu Gamka) than in the other two areas.

Conclusion: The results suggest a positive association between high F levels in the drinking water and dental caries. Furthermore, a low caries experience and no difference in DMFT and fluorosis between the two low fluoride areas were found.

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Keywords: Dental caries, Dental fluorosis, Fluoride in water, South Africa.
Source: Int J Paediatr Dent 2001 Sep;11(5):372-9.

Prevalence of dental fluorosis in the primary dentition

Objectives: This paper presents data on the prevalence of primary tooth fluorosis among children residing in Iowa, and the relationships between fluorosis prevalence and selected measures of fluoride exposures.

Methods: Children in the study cohort were followed prospectively during the first year of life. This study assessed their home water fluoride concentrations and use of fluoride dentifrice or dietary fluoride supplements. A total of 637 children (320 females and 317 males) were examined for fluorosis using a modification of the TSIF index at age 4 1/2 to 5 years, with 90.4 percent having intact primary dentitions.

Results: 74 children (11.6%) had fluorosis present on one or more of their primary teeth, and 71 children (11.1%) had two or more teeth affected. Nearly

all fluorosis was mild, with the primary second molar teeth most commonly affected. Fluorosis was significantly associated with higher water fluoride concentration, but not with the use of dentifrice or fluoride supplements.

Conclusions: The results of this study show that primary tooth fluorosis is relatively uncommon, but is most frequently seen on the posterior teeth, particularly the primary second molars, which form at later stages of development. This finding suggests that primary tooth fluorosis is mostly a postnatal phenomenon, and is associated with higher water fluoride levels.

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Keywords: Dental fluorosis, Primary dentition.
Source: J Public Health Dent 2001 Spring;61(2):87-91.

Renal Toxicity with Sevoflurane: A Storm in a Teacup?

The inhaled anaesthetic sevoflurane is metabolized into two products that have the potential to produce renal injury. Fluoride ions are produced by oxidative defluorination of sevoflurane by the cytochrome P450 system in the liver. Until recently, inorganic fluoride has been thought to be the etiological agent responsible for fluorinated anaesthetic nephrotoxicity, with a toxic concentration threshold of 50 µmol/L in serum. However, studies of sevoflurane administration in animals and humans have not shown evidence of fluoride-induced nephrotoxicity, despite serum fluoride concentrations in this range. Compound A (fluoromethyl-2,2-difluoro-1-[trifluoromethyl] vinyl ether) is a breakdown product of sevoflurane produced by its interaction with carbon dioxide absorbents in the anesthesia machine. The patient then inhales compound A. Compound A produces evidence of transient renal injury in rats. The mechanism of compound A renal toxicity is controversial, with the debate focused on the role of the renal cysteine conjugate beta-lyase pathway in the biotransformation of compound A. The significance of this debate centers on the fact that the beta-lyase pathway is 10- to 30-fold less active in humans than in rats. Therefore, if biotransformation by this pathway is responsible for the production of nephrotoxic metabolites of compound A, humans may be less susceptible to compound A renal toxicity than are rats. In three studies in human volunteers and one in surgical patients, prolonged (8-hour) sevoflurane exposures and low fresh gas flow rates resulted in significant exposures to compound A. Transient abnormalities were found in biochemical markers of renal injury measured in urine. These studies suggested that sevoflurane can result in renal toxicity, mediated by compound A, under specific circumstances. However, other studies using prolonged sevoflurane administration at low flow rates did not find evidence of renal injury. Finally, there are substantial data to document the safety of sevoflurane administered for shorter dura-

tions or at higher fresh gas flow rates. Therefore, the United States Food and Drug Administration recommends the use of sevoflurane with fresh gas flow rates at least 1 L/min for exposures up to 1 hour and at least 2 L/min for exposures greater than 1 hour. We believe this is a rational, cautious approach based on available data. However, it is important to note that other countries have not recommended such limitations on the clinical use of sevoflurane and problems have not been noted.

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Keywords: Renal toxicity, Sevoflurane.
Source: Drugs 2001;61(15):2155-62.

Occurrence and management of dental fluorosis

The prevalence of dental fluorosis is on the increase in different parts of the world, even in areas with fluoride-deficient public water supplies. This may be due to increased use of fluoride in preventive dentistry. In some countries, exposure to apparently low fluoride concentrations in drinking water has resulted in severe dental fluorosis in some children. This underscores the importance of taking into consideration all sources of fluoride intake in a community before prescribing fluoride supplements or recommending appropriate fluoride concentration for the public water supply. Preventive management of dental fluorosis includes de-fluoridation of drinking water in endemic areas, cautious use of fluoride supplements and supervision of the use of fluoride toothpaste by children aged below 5 years. Aesthetically objectionable discoloration of fluorosed teeth may be managed by bleaching, micro-abrasion, veneering or crowning. The choice between these treatments depends on the severity of the fluorosis and this may be satisfactorily determined by the Thylstrup and Fejerskov index.

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Keywords: Dental fluorosis, Saudi Arabia.
Source: Int Dent J 2001 Oct;51(5):325-33.

Topical fluorides in caries prevention and management: a North American perspective

A review of evidence-based literature indicates incomplete evidence for the efficacy of most measures currently used for caries prevention, with the exception of fluoride varnishes and the use of fluoride-based interventions for patients with hyposalivation. Not all fluoride agents and treatments are equal.

Different fluoride compounds, different vehicles, and vastly different concentrations have been used with different frequencies and durations of application. These variables can influence the clinical outcome with respect to caries prevention and management. The efficacy of topical fluoride in caries prevention depends on a) the concentration of fluoride used, b) the frequency and duration of application, and to a certain extent, c) the specific fluoride compound used. The more concentrated the fluoride and the greater the frequency of application, the greater the caries reduction.

Factors besides efficacy, such as practicality, cost, and compliance, influence the clinician's choice of preventive therapy. For noncavitated smooth surface carious lesions in a moderate caries-risk patient, the appropriate fluoride regimen would be semiannual professional topical application of a fluoride varnish containing 5 percent NaF (22,600 ppm of fluoride). In addition, the patient should use twice or thrice daily for at least one minute a fluoridated dentifrice containing NaF, MFP, or SnF2 (1,000-1,500 ppm of fluoride), and once daily for one minute a fluoride mouthrinse containing .05 percent NaF (230 ppm of fluoride). If the noncavitated carious lesion involves a pit or fissure, the application of an occlusal sealant would be the most appropriate preventive therapy.

The management of the high caries-risk patient requires the use of several preventive interventions and behavioral modification, besides the use of topical fluorides. For children over six years of age and adults, both office and self-applied topical fluoride treatments are recommended. For office fluoride therapy at the initial visit, a high-concentration agent, either a 1.23 percent F APF gel (12,300 ppm of fluoride) for four minutes in a tray or a 5 percent NaF varnish (22,600 ppm of fluoride), should be applied directly to the teeth four times per year. Self-applied fluoride therapy should consist of the daily five-minute application of 1.1 percent NaF or APF gel (5,000 ppm of fluoride) in a custom-fitted tray. For those who cannot tolerate a tray delivery owing to gagging or nausea, a daily 0.05 percent NaF rinse (230 ppm of fluoride) for 1 minute is a less effective alternative. In addition, the patient should use twice or thrice daily for at least 1 minute a fluoridated dentifrice as described above for treatment of noncavitated carious lesions.

In order to avoid unintentional ingestion and the risk of fluorosis in children under six years of age, fluoride rinses and gels should not be used at home. Furthermore, when using a fluoride dentifrice, such children should apply only a pea-size portion on the brush, should be instructed not to eat or swallow the paste, and should expectorate thoroughly after brushing. Toothbrushing should be done under parental supervision. To avoid etching of porcelain crowns and facings, neutral NaF is indicated in preference to APF gels for those patients who have such restorations and are applying the gel daily. The rationale for these recommendations is discussed. Important deficiencies in our knowledge

that require further research on topical fluoride therapy in populations with specific needs are identified.

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Source: J Dent Educ 2001 Oct;65(10):1078-83.

Endemic fluorosis in Turkish patients: relationship with knee osteoarthritis

Fluoride excess primarily affects dental and skeletal tissues. leading to a condition known as endemic fluorosis. The radiological and clinical features of endemic fluorosis vary in different parts of the world. The aim of this study was to investigate the clinical and radiological features of endemic fluorosis in Turkish patients. Physical examination and radiological investigations were performed in 56 patients with endemic fluorosis and 40 age- and sex-matched controls. Knee osteoarthritis (OA) was the main abnormality in both groups, both clinically and radiologically. The radiological severity of knee OA was greater in the endemic fluorosis group than in controls (P=0.01). Osteophytes at the tibial condyles and superior margin of the patellar articular surface of the femur, polyp-like osteophytes on the non-weight-bearing medial side of the femoral condyle, and popliteal loose bodies were detected more frequently in the endemic fluorosis group than in controls (P=0.0001). We suggest that the presence of atypically located osteophytes in the knees may be a feature of endemic fluorosis in Turkish patients and that endemic fluorosis may increase the severity of OA in the knees.

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Keywords: Arthritis, Fluorosis, Osteoarthritis, Turkey.
Source: Rheumatol Int 2001 Sep;21(1):30-5.

DIETARY FLUORIDE

Fluoride content of foods made with mechanically separated chicken

The fluoride content of foods made from chicken and turkey mechanically separated from bone was determined with a combination fluoride electrode following perchloric acid-facilitated diffusion of HF. Brand A pureed infant foods prepared from chicken contained 3.22-8.63 ppm F (mean 5.58 ppm); brand B contained 1.89-4.63 ppm F (mean 2.82 ppm). Pureed infant food prepared from turkey had a significantly lower mean F content: 0.78 ppm.

Chicken meat sticks contained 1.61-6.00 ppm F (mean 3.61 ppm); the mean F content of turkey meat sticks was 1.37 ppm. Brand A chicken luncheon meat contained 1.53-3.65 ppm F (mean 2.35 ppm); brand B contained 1.04-2.64 ppm F (mean 1.60 ppm); turkey luncheon meat: 1.07 ppm. A significant correlation of calcium with the higher fluoride content of chicken products suggests that the mechanical deboning process was the source of the extra fluoride. Although turkey bone usually has a higher fluoride content than chicken bone (340 µg/g bone ash vs. 275 µg/g bone ash), it crushes and powders less easily than chicken bone. Therefore foods made from mechanically separated turkey are not usually a major source of fluoride.

Based on recent USA IOM-NAS recommendations, the findings with the chicken foods indicate that a single 71-g serving of infant food made from mechanically separated chicken could provide as much as 0.6 mg of fluoride, which is twice the AI (adequate intake) and 87% of the UL (upper limit of safety) intake, for a 6-month-old baby. For one-year-olds, a single 71-g serving of chicken sticks could provide 0.4 mg of fluoride, which nearly matches the suggested AI and is about half the UL. Excessive fluoride intake could therefore occur from regular use of these foods, especially when added to other sources of fluoride intake such as fluoridated water, formulas, and beverages prepared from fluoridated water, and fluoridated toothpaste.

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Keywords: Fluoride in chicken, Fluoride in food, Fluoride in turkey, Mechanical deboning.
Abstracted from: J Agric Food Chem 2001 Sep;49(9):4284-6.

Fluoride concentration of bottled drinking waters

The use of bottled water and beverages may be a significant source of systemic fluoride and can therefore be considered as a risk factor for dental fluorosis in young children. The aim of this study was to determine the fluoride content of commercially available bottled drinking waters and to report on the accuracy of the labeling of fluoride concentration. Thirty brands of bottled water, classified as either spring (N=19) or mineral (N=11) water were evaluated. A fluoride ion-selective and a fluoride reference electrode were used to measure the fluoride concentrations. The average reading for each brand was compared with the fluoride content printed on the label. Only 56.7% (N=17) of brands tested mention the fluoride concentration on the label, but 73.3% (N= 22) had a tested fluoride concentration of less than 0.3 ppm. Of the 8 brands testing higher than 0.3 ppm fluoride, one did not have the fluoride concentration labeled, while for another the tested fluoride concentration was much higher than the concentration printed on the label. When prescribing fluoride supplements,

dentists should be aware of the fluoride content of bottled waters used by child patients, especially brands with a concentration higher than 0.3 ppm.

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Keywords: Fluoride in bottled water.
Source: SADJ 2001 Jun;56(6):273-6.

BIOCHEMICAL EFFECTS

Involvement of heterotrimeric G proteins in phagocytosis and recycling from the phagosomal compartment

Phagocytosis is a receptor-mediated process by which specialized cell types engulf large extracellular particles. Phagosome maturation involves a series of intracellular membrane fusion and budding events resulting in the delivery of particles to compartments enriched in lysosomal hydrolases where they are digested. Substantial amounts of plasma membrane and many phagosomal proteins, such as receptors, rapidly recycle to the plasma membrane following phagosome formation. Despite the importance of this recycling pathway in phagosome maturation and in the retrieval of immunogenic peptides from phagosomes, the molecular machinery involved is largely unknown. To assess the participation of GTPases in phagocytosis and recycling from phagosomes we used aluminum fluoride (AlF_4^-), which activates the GDP-bound form of stimulatory and inhibitory trimeric G proteins. AlF_4^- inhibited both the uptake to and the recycling from the phagosomal compartment. Cholera toxin, which activates Galphas, and pertussis toxin, which uncouples Gi and Go from receptors, were effective inhibitors of phagocytosis. However, both toxins stimulated recycling from phagosomes. These results suggest that more than one GTP-binding protein participates either directly or indirectly not only in phagocytosis, but also in maturation and recycling from phagosomes, and thereby assign a role for heterotrimeric G proteins in controlling traffic through the phagocytic pathway.

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Keywords: Aluminofluoride complexes, G proteins, Phagocytosis.
Source: Exp Cell Res 2001 Nov 15;271(1):189-99.

Mechanisms in fluoride-induced interleukin-8 synthesis in human lung epithelial cells

Sodium fluoride (NaF) has previously been reported to induce a strong IL-8 response in human epithelial lung cells (A549) via mechanisms that seem to

involve the activation of G proteins. In the present study the signal pathways downstream of the G proteins have been examined. NaF induced a weak, but sustained increase in PKC activity. In contrast, the PKC activator TPA induced a relatively strong, but transient effect and augmented the NaF-induced PKC activity. TPA induced a marked IL-8 response compared to NaF. PDB, another PKC activator, was less effective, but augmented the IL-8 response to NaF. Pretreatment with TPA for 20 h, or the PKC inhibitor GF109203X for 1 h, abolished the basal and NaF-induced PKC activities and partially prevented the NaF-induced IL-8 response. Inhibition of the MAP kinase p38 by SB202190 partially reduced the IL-8 response to NaF, whereas a reduction in ERK activity by PD98059 led to an increased response. The NaF-induced IL-8 response was weakly augmented by the PKA stimulator forskolin and the G(i) inhibitor pertussis toxin. The PKA inhibitor H89 seemed to reduce the NaF-induced IL-8 response, but the measured effect was not statistically significant. BAPTA-AM, KN93 and W7, that inhibit Ca^{2+}-linked effects, did not affect the IL-8 response. Furthermore, the tyrosine kinase inhibitor genestein, the PI-3 kinase inhibitor wortmannin and phosphatase inhibition were without effects. In conclusion, the data suggest that NaF-induced increase of IL-8 in A549 cells involved PKC- and p38-linked pathways, whereas an ERK-dependent pathway counteracted the response. Tyrosine kinases, Ca^{2+}-linked pathways, PI-3 kinase, PKA and phosphatase inhibition seem to play no or minor roles in the fluoride-induced IL-8 response.

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Keywords: G proteins, Sodium fluoride.
Source: Toxicology 2001 Oct 15;167(2):145-58.

Contractile hyporesponsiveness of hepatic arteries in humans with cirrhosis: evidence for a receptor-specific mechanism

Splanchnic vasodilatation and vascular hyporesponsiveness to vasopressors are characteristic features of patients with cirrhosis. Although the vascular response to different vasopressors has been shown to be attenuated in cirrhosis, alterations on the receptor level are discussed controversially. Thus, impaired postreceptor signaling has been postulated. However, so far this has not been studied in human splanchnic vessels. Therefore, we assessed the vascular response of human hepatic arteries after activating the G-protein-dependent signal transduction pathway by stimulation with angiotensin II, the thromboxane A(2) analog U46619, or by G-protein activation with $NaF/AlCl_3$. After endothelium denudation, cumulative isometric concentration contraction curves were obtained for hepatic arteries from 32 cirrhotic patients undergoing liver transplantation and from 40 organ donors after stimulation with either angio-

tensin II (10^{-11}-10^{-5} mol/L), U46619 (10^{-10}-10^{-6} mol/L) or $AlCl_3$ (30 µmol/L)/NaF (10^{-4}-3 x 10^{-2} mol/L). Hepatic arteries from cirrhotic patients were markedly less responsive to angiotensin II ($P < 0.0001$) than those from organ donors. Both stimulation of the G-protein phospholipase C pathway via the thromboxane A(2) receptor and receptor-independent G-protein stimulation with $AlCl_3$/NaF, induced an intact contractile response. In conclusion, the G-protein-dependent signal transduction system itself is unaltered in cirrhosis. Hence, the cause of the hyporesponsiveness to some vasoconstrictors in cirrhosis appears to be a receptor-specific phenomenon localized upstream from the G-protein level.

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Keywords: Aluminofluoride complexes, G proteins, Sodium fluoride.
Source: Hepatology 2001 Nov;34(5):884-8.

Attenuated agonist evoked vasoconstrictor responses in the perfused mesenteric vascular bed of streptozotocin diabetic rats

We compared agonist-evoked responses in the perfused mesenteric vascular bed (MVB) of streptozotocin (STZ) diabetic Sprague-Dawley rats 2 and 14 weeks after induction of diabetes. Endothelin-1 (ET-1)-, methoxamine (MTX)-, and KCl-evoked vasoconstrictor responses were unchanged in 2-week-old diabetic rats. In contrast, both the sensitivity ($P < 0.01$) and the maximal vasoconstrictor responses ($P < 0.05$) to ET-1 were attenuated in 14-week-old diabetic rats, whereas endothelin plasma levels were increased ($P < 0.05$). Although no differences were observed in responses to KCl in either the 2- or 14-week-old diabetic groups, MTX-evoked maximal responses were attenuated in the 14-week-old group ($P < 0.01$). Changes in agonist-evoked responses in the 14-week-old diabetic group were unaffected by the protein kinase C (PKC) inhibitor, staurosporine, the phospholipase C (PLC) inhibitor, U73122, the calcium channel blocker, nifedipine, the calcium pump inhibitor, cyclopiazonic acid (CPA), or by endothelial denudation. Sodium fluoride, an activator of guanosine triphosphate binding proteins (G proteins) normalized the responses in the 14-week-old diabetic group. These data suggest that advanced stages of STZ are associated with alterations in G protein receptor coupling and/or activity leading to the attenuation of responses to vasoconstrictor agonists.

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Keywords: G proteins, Sodium fluoride.
Source: Exp Biol Med (Maywood) 2001 Nov;226(10):940-6.

A novel regulator of G-protein signaling bearing GAP activity for Galphai and Galphaq in megakaryocytes

The regulator of G-protein signaling (RGS) negatively regulates the alpha subunit of G proteins by accelerating their intrinsic guanosine triphosphatase (GTPase) activity. Here are reported the isolation and characterization of a novel mouse RGS, termed RGS18, which is a new member of RGS subfamily B. Northern blot analysis showed that RGS18 messenger RNA was detected predominantly in spleen and hematopoietic cells, and immunohistochemical studies demonstrated that RGS18 was expressed in megakaryocytes, platelets, granulocytes/monocytes, and, weakly, in hematopoietic stem cells, but not in lymphocytes or erythrocytes. Although various subcellular localizations of RGS have been reported, RGS18 was found to be localized in cytoplasm in megakaryocytes. In vitro binding assays of RGS18 with megakaryocyte cell lysates with or without AlF_4^- treatment demonstrated that RGS18 specifically binds to 2 alpha subunits of the G protein, Galphai and Galphaq. Furthermore, RGS18 clearly exhibited GTPase-activating protein (GAP) activity for Galphai and Galphaq but not for Galphas or Galpha12. In addition, chemokine stromal-derived factor 1 (SDF-1), which has been reported to stimulate megakaryocyte colony formation in the presence of thrombopoietin, affected the binding of RGS18 to Galphai but not to Galphaq. Therefore, the newly isolated RGS18 turned out to be a new member of the RGS family bearing GAP activity for Galphai, which might be stimulated by SDF-1 in megakaryocytes, as well as for Galphaq. Thus, RGS18 may play an important role in proliferation, differentiation, and/or migration of megakaryocytes.

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Keywords: Aluminofluoride complexes, G proteins.
Source: Blood 2001 May 15;97(10):3051-60.

Sodium fluoride induces changes on proteoglycans synthesized by avian osteoblasts in culture

The results reported here show that sodium fluoride (NaF) at low concentration (up to 10 µM) increased four times the proliferation rate of avian osteoblasts in culture. Also NaF increases, in a concentration dependent manner, 10 times the alkaline phosphatase activity. However, NaF decreased the incorporation of ^{35}S-sulfate into proteoglycans (PGs) synthesized by osteoblasts (60-65%). Also, we observed that PGs synthesized in the presence of NaF (50 µM) exhibited a higher sensitivity to chondroitinase ABC than PGs synthesized by osteoblasts in the absence of NaF, suggesting an increase in the chondroitin sulfate moieties associated with the core protein of PGs. The modification of

glycosaminoglycan (GAG) chains composition was evidenced also by change in the mean charge density of the PGs observed by ion exchange chromatography. Since the ratio of $^{35}SO_4/^3H$-glucosamine incorporated into PGs was similar in the presence and in the absence of NaF (8.2 and 7, respectively), it is not possible to explain differences in mean charge density by changes in the sulfation extent of PGs. No differences were observed in the hydrodynamic size of PG synthesized in the presence of NaF, nor in the hydrodynamic size of the GAG chains. According to these results, we speculate that the stimulatory effect of fluoride on bone mineralization may be mediated, in part, by the changes in the rate of synthesis or in the structural characteristics of bone PGs. The changes produced by fluoride in PGs suggest that these molecules play an inhibitory role in the bone mineralization process.

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Keywords: Bone mineralization, Proteoglycans, Sodium fluoride.
Source: J Cell Biochem 2001;83(4):607-16.

ENVIRONMENTAL FLUORIDE POLLUTION

Fluoride accumulation in pasture forages and soils following long-term applications of phosphorus fertilizers

Ingestion of soils with high fluoride (F) concentration may cause chronic fluorosis in grazing animals. Analysis of New Zealand pasture soils with long-term phosphorus (P) fertilization histories showed that total surface soil (0-75 mm depth) F concentration increased up to 217-454 mg/kg with P fertilizer application. One-third to two-thirds of F applied in fertilizers resides in the top 75 mm soil depth. Pasture forage accumulation of F was low, and therefore, F intake by grazing animals through pasture consumption is expected to be much lower than F intake by soil ingestion. Ten annual applications of single superphosphate (30 and 60 kg P/ha/yr) to a Pallic Soil (Aeric Fragiaqualf) significantly increased total F and labile F (0.01 M $CaCl_2$ extract) concentrations to 200 and 120 mm depths, respectively, of the 300 mm depth investigated. The mobility of F in the soil profile was similar to two other elements, P and cadmium derived from the fertilizer.

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Source: Environ Pollut 2001;115(2):275-82.