

CHRONIC EFFECTS OF FLUORIDE ON GROWTH, BLOOD CHEMISTRY, AND THYROID HORMONES IN ADOLESCENTS RESIDING IN THREE COMMUNITIES IN NORTHERN MEXICO

Abstract number:
37
XXVIth ISFR Conference

This study was designed to evaluate adverse health effects in adolescents from chronic exposure to various water fluoride concentrations in three communities located in northern Mexico: Ciudad Juarez, Samalayuca, and Villa Ahumada. In these communities the fluoride concentration in water averages 0.3, 1.0, and 5.3 mg/L, respectively. The residents of Villa Ahumada have been exposed to excessive levels of fluoride in drinking water since their birth.

Using urinary fluoride as biomarker, we evaluated the effect of fluoride on dental fluorosis, growth, thyroid hormones, hepatic function, lipids, uric acid, and electrolytes. A total of 201 adolescents (106 female, 95 male), aged 15–20, were included in the study. Each participant donated blood and urine samples, was weighed, measured for height, and answered a questionnaire which requested sociodemographic information and water intake practices. The fluoride concentration in water and in urine samples was analyzed using the US EPA Ion-Selective Method. Dental fluorosis was assessed using the Dean's Index. Biochemical parameters and thyroid hormones levels were measured by standard procedures. ANOVA, Chi Square, and Student's t test were used in the statistical analysis of results.

The mean urinary fluoride concentration in adolescents living in these communities was 0.792 ± 0.39 mg F/g creatinine ($n = 66$), 1.32 ± 0.57 mg F/g creatinine ($n = 65$), and 2.22 ± 1.16 mg F/g creatinine ($n = 70$), in Cd. Juarez, Samalayuca, and Villa Ahumada, respectively. In Villa Ahumada 97 percent of all adolescents exhibited dental fluorosis, and 18 percent of them have serious damage to their teeth. In Samalayuca 53 percent of all adolescents exhibited mild dental fluorosis, 15 percent of them have moderate dental fluorosis, and 2 percent showed serious damage in their teeth. In Villa Ahumada a significant inverse relationship was found between urine fluoride levels and stature; this association suggests that fluoride exposure may affect the teeth but also the growth of adolescents. Serum samples of these individuals showed elevated levels of alkaline phosphatase (ALP), potassium, magnesium, calcium, and phosphate, and decreased levels of thyroid hormone T_3 and uric acid.

These findings show that high fluoride ingestion has a definite relationship with the prevalence and severity of dental fluorosis, decrease of stature, and decrease of thyroid hormone secretion. Uric acid is one of the important antioxidants of plasma, and its level was lower in fluorotic adolescents, indicating that fluoride toxicity may involve a reduction on certain intrinsic scavengers resulting in an increased vulnerability to oxygen free radical toxicity.

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Keywords: Adolescents; Blood chemistry; Dental fluorosis; Fluoride in drinking water; Growth retardation; Northern Mexico; Thyroid hormone T_3 ; Urinary fluoride.