

Article

Bone Mineral Density, Water Fluoride Intake, and Dental Fluorosis in Adults from Northwest Mexico

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Abstract: Background: Dental fluorosis (DF) is an irreversible alteration of tooth enamel formation caused by excessive fluoride (F) consumption during tooth growth, leading to skeletal fluorosis development due to the high F content of tap water, which should be detected. Objective: To detect the signs of skeletal fluorosis by comparison of the bone mineral density (BMD) of the lumbar spine, femoral neck, and total femur, and the fluor (F) intake from water between adults without and with DF from northwestern Mexico. Methods: Participants were 36 adults without DF (G1) and 42 with DF (G2). Dean criteria, DEXA, and SPADNS methods were used to evaluate DF, BMD, and F content in water, respectively. Results. G1 participants consumed 0.789 ± 1.55 mg F/d from water with 0.385 ± 0.32 mg F/L, while G2 participants drank 2.42 ± 2.65 mg F/d from water with 1.46 ± 0.59 mg F/L. The binary variable DF and BMD values were not associated ($p > 0.05$); however, according to severity degree, questionable DF was associated with total femur BMD ($p = 0.025$). BMD in the evaluated regions was no different between both groups and could be related to actual moderate levels of F in the tap water and to the partial or total consumption of bottled water. Conclusions. There was no association between DF and the measured BMD to infer skeletal fluorosis. Bone region BMD was no different between both evaluated groups and could be related to adequate F intake, with moderate F levels in tap water, and the consumption of negligible F content bottled water.



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1. Introduction

Fluoride (F), the anion of fluorine, is characterized by its affinity for calcified tissues, which stimulates bone formation and maintains bone mineral density (BMD) [1]. The adequate fluoridation of drinking water prevents dental caries and can reduce the incidence of hip fractures due to osteoporosis in the elderly population [2]. However, excessive F consumption during tooth growth in childhood can cause dental fluorosis (DF), a disorder of the development of the enamel with signs of white lines or brown spots on the teeth; and it could advance to skeletal fluorosis and affect soft body tissues. Due to the risk, attention has been focused on the negative effects at the dental and skeletal levels [2,3].

The main sources of F are drinking water, other beverages, watery foods, and fluoridated products used in oral hygiene. The World Health Organization (WHO) has recommended F below 1.5 mg/L in drinking water, with variations according to weather conditions, as accepted in Mexico [4]. Colombian schoolchildren presented a higher prevalence of dental fluorosis associated with ingested tap water with high F concentration, depending on weather and altitude [5]. The northwestern area in Mexico is part of a big

desert, where Sonora state is placed. The capital is Hermosillo, with temperatures ranging from 32 to 47 °C and relative humidity lower than 10% for at least six months of the year. Thirty years ago, the F content in drinking water ranged from 0.2 to 7.82 mg/L, and DF in children of the north area of the town was prevalent [6]. There are no published studies about the current bone health of the affected inhabitants.

Skeletal fluorosis in adults has been associated with an excess of F in the drinking water, although other factors could be involved, such as diet, time of exposure, and hot climate. Associations have been found between DF and skeletal abnormalities and BMD. For instance, the density of the lumbar spine was 112% higher in adults with DF than in persons without this condition. Also, 86.5% of children with advanced DF showed signs of abnormal wrist skeletal development compared with controls of the same sex and age [7].

Nowadays, it is important to know whether the strategies implemented to reduce the F content in tap water have been enough to avoid signs of skeletal fluorosis for the inhabitants of our study place in northwestern Mexico, although the actual DF prevalence has decreased. Therefore, our aim was to analyze the current conditions of the F content of tap water and its consequences on the health of the former children with DF, detected as changes in BMD, by comparison of BMD of the lumbar spine, femoral neck, and total femur, and the fluor (F) intake from water between adults without and with DF.

2. Materials and Methods

2.1. Study Design

This was a cross-sectional analytical study. The selection of participants was performed using non-probabilistic convenience sampling in Hermosillo, in northwest Mexico. Adult men and women were invited to participate during their visits to the public health centers for routine reviews. The calculated sample size per group was 45. Two groups were formed as follows: G1 included participants who had lived from childhood to the present in the southern and southeast areas of the city, where F levels in water have been low or adequate (<0.7 mg/L); G2 consisted of apparently healthy adult men and women who presented some degree of DF and had lived in the northern part of Hermosillo from birth to the time of this study. This last zone has had high levels of F in drinking water (≥ 0.7 mg/L). In the study year, the weather conditions had a maximum average annual temperature of 38.5 °C, although, from April to September, the maximum average was 42.8 °C [8]. Exclusion criteria were the use of drugs interfering with bone metabolism (anticonvulsants and thyroid disease) or hormonal therapy, along with pregnancy or nursing. All participants signed an informed consent form, and the study protocol was approved by our institute's ethics committee (CEI/007/2015).

2.2. Dental Fluorosis Assessment

The severity and grading of DF were identified and classified by dentists according to the Dean criteria with a six-point scale [9]. The scores of the scale are as follows: score 0: unaffected; score 0.5: questionable, with occasional white spots; score 1: very mild, with scattered small opaque white areas; score 2: mild, white opaque areas in 50% of the surface; score 3: moderate, with white opaque areas in more than 50% of the surface; score 4: severe, with presence of confluent pitting on the enamel surface. The two most affected teeth were evaluated.

2.3. Socioeconomic Level

A questionnaire was applied to assess the subjects' socioeconomic level, which contained eight indicators on housing conditions, schooling, and income. The classification was divided into seven levels according to the added score (A/B, C+, C, C−, D+, D, or E),

where A/B was the highest and E was the lowest, according to the Mexican Association of the Market Opinion [10].

2.4. Anthropometric Evaluation

Body weight was measured on an electronic scale with a capacity of $0\text{--}150 \pm 0.05$ kg (AND FV-150 KA1, A & D CO., LTD, Tokyo, Japan), and height was determined using a $20\text{--}210 \pm 0.1$ cm SECA stadiometer, Model 213 (SECA, Chino, CA, USA). Subjects were placed on the Frankfort plane to assess height and weight. The body mass index (BMI) was calculated by measuring the participants' body weight divided by the square of their height (kg/m^2) and then classified according to the following cut-off points: low weight, $\text{BMI} < 18.5$; normal, $\text{BMI} 18.5\text{--}24.9$; overweight, $\text{BMI} 25.5\text{--}29.9$; and obesity, $\text{BMI} > 30$ [11].

2.5. Physical Activity

Physical activity levels were recorded using a two-day activity diary, one weekday and one day on the weekend. An average from these two recordings was estimated, and physical activity level was calculated in terms of multiples of basal metabolism using the following cutoff points: ≤ 1.69 for sedentary; $1.70\text{--}1.99$ for moderate; and $2.0\text{--}2.4$ for intense [12].

2.6. Bone Mineral Density Assessment

Measurements of lumbar vertebrae (L2-L4) and right femur (neck and total) in g/cm^2 , as measurements of the bone mineral density (BMD), were taken on a dual-energy X-ray absorptiometry densitometer (DEXA), model DPX-MD+, Lunar, software 5.0 (GE HealthCare, Waukesha, WI, USA), according to Lorente [13].

2.7. Estimation of Water, Fluoride, and Calcium Consumption

Water consumption was estimated by averaging two non-consecutive 24 h dietary recalls, adding information on the water source used to prepare homemade beverages and the quantity and sources (tap or bottled) of water consumed [14]. Also, the recalls collected information about the intake of carbohydrates, lipids, and proteins. F consumption was estimated considering total F intake from tap or bottled water sources. A validated food frequency questionnaire for the Mexican population was used to estimate Ca consumption in the previous year. The latter was a list of 104 foods with questions to verify a person's monthly, weekly, or daily consumption frequency [15]. Analysis was performed using a software system for evaluating nutritional habits and nutrient consumption designed by the National Institute of Public Health in Mexico [16].

2.8. Collection of Water and Fluoride Analysis

We collected samples of bottled water and tap water from each participant's house. In addition to individually bottled water ($300\text{--}1000$ mL), 20 L bottles of purified water commercially processed by reverse osmosis for drinking are commonly used in-house. All samples were stored at -4 °C until analysis in plastic containers previously washed with 10% nitric acid and deionized water. The analysis of F was made by the SPADNS colorimetric method [17], using a spectrometer Genesys 10UV (Thermo Fisher Scientific, Waltham, MA, USA) at 570 nm. The calibration curve for measurements contained 0.02, 0.2, 0.6, 1, 1.4, and 1.8 mg F/L; if necessary, samples were diluted with deionized water for fitting the curve.

2.9. Statistical Analysis

Descriptive statistics were used to calculate means and standard deviations. Data without normal distribution were transformed into logarithms. Comparisons between G1

and G2 were made using a Student's *t*-test for independent samples. Mann–Whitney U tests analyzed data that did not achieve a normal distribution.

Multiple linear regression analyses were performed to evaluate the associations of the dependent variables of BMD from the lumbar spine, femur neck, and total femur with the categorical DF index type. This variable was explored as dichotomous (0: no DF; 1: yes DF), and as polychotomous using four categories (1: no DF or 0; 2: questionable; 3: very mild/mild; 4: moderate/severe DF. The adjustment variables tested were sex, BMI, physical activity, anthropometric evaluation, and calcium intake. Preliminary models (normality, linearity, homoscedasticity) were evaluated, and collinearity was discarded. Data were analyzed using the NCSS 2007 statistical program, with significance set at $p \leq 0.05$.

3. Results

Participant Characteristics

In Group 1 (G1), there were 36 participants without DF (G1), while, in Group 2 (G2), there were 42 participants with DF, all of them were from 27 to 45 years old. According to the DF severity, G2 was separated into three sub-groups: questionable degree ($n = 5$); very mild plus mild degree ($n = 26$); and moderate plus severe degree ($n = 11$). The means of BMI in G1 and G2 were 42% and 48% with obesity, 30% and 31% were overweight, and 28% and 19% with normal weight, respectively. In relation to physical activity, 92% of G1 and 90% of G2 were sedentary, and the rest showed moderate intensity. Mean Ca intake reached 55% of the recommended level for persons aged 19–50 years (1000 mg/day) [18]; only five (6%) participants fulfilled this recommendation. Milk, cheese, corn flour tortillas, yogurt, and pozole (Mexican dish of corn and beef) were the main food sources of Ca. In terms of socioeconomic status, the distribution of the participants in the A/B, C, and D levels was 15%, 58%, and 27%, respectively.

Table 1 shows the comparison of data of age, BMI, dietary Ca, BMD of lumbar spine, femur neck, and total femur between 36 participants without DF (G1) and 42 with DF (G2). There were no statistical differences between groups ($p > 0.05$) for any variable, except that total femur BMD tended ($p = 0.06$) to be higher in G2 compared with G1.

Table 1. Comparison of age, BMI, dietary Ca, lumbar spine, femur neck, and total femur BMD between the participant groups.

Parameter	G1 ($n = 36$)	G2 ($n = 42$)	<i>p</i> -Value
Age (years)	37.5 ± 5.6	36.4 ± 5.6	0.41
BMI (kg/m ²)	30.0 ± 7.0	30.5 ± 7.6	0.76
Dietary Ca (mg/d)	516 ± 252.7	591.7 ± 255.6	0.19
BMD (g/cm ²)			
Lumbar spine	1210.7 ± 135.2	1232.5 ± 124.1	0.40
Femur neck	1020.3 ± 121.7	1063.4 ± 105.8	0.09
Total femur	1047.1 ± 146.4	1105.5 ± 130.4	0.06

Values are Mean ± SD. G1—group without DF; G2—group with DF; BMI—body mass index, BMD—bone mineral density; Student *t*-test for independent samples. Significance level $p \leq 0.05$.

There was no association between DF and BMD of the lumbar spine ($p = 0.459$), femur neck ($p = 0.098$), or total femur ($p = 0.066$) after exploratory analysis, when DF was used as a binary variable (absence 0 or presence 1). However, when DF was divided into four categories—no DF or reference, questionable DF, very mild + mild DF, and moderate + severe DF—a significant association was found between questionable DF and total femur BMD ($p = 0.025$), after adjusting for physical activity, BMI, Ca intake, and sex (Table 2).

Table 2. Association of lumbar spine, femur neck, and total femur BMD with DF degree in the study participants.

Dental Fluorosis Degree		Lumbar Spine (g/cm ²)	Femur Neck (g/cm ²)	Total Femur (g/cm ²)
Questionable (<i>n</i> = 5)	β	89.28	102.4	132.93
	p	0.153	0.055	0.025
Very mild + mild (<i>n</i> = 26)	β	29.1	16.37	36.4
	p	0.36	0.547	0.23
Moderate + severe (<i>n</i> = 11)	β	7.19	59.82	29.6
	p	0.87	0.10	0.48

DF—dental fluorosis. Reference—no DF (*n* = 36); β—regression coefficient; p—level of significance $p \leq 0.05$; model adjusted for physical activity, log BMI, Ca intake, and sex.

We analyzed 156 water samples, 78 of them were bottled water, and 78 were tap water. The F concentration in the tap water (mg/L) was higher in the G2 neighborhoods than in the G1 areas ($p = 0.000$) (Table 3). In G2, 88% of the tap water samples were above the suggested optimum F concentration, 0.5–0.7 mg/L, for regions with high temperatures, and 42% surpassed the limit set by the Official Mexican Standards (1.5 mg/L) [4]. Thirty-three percent of participants said they only drank bottled water, nineteen percent only used tap water, and forty-eight percent used both sources. In G1, 3% of the tap water samples were above the 0.7 mg/L recommended, and the proportions of participants who consumed only bottled water, only tap water, and both sources were 25%, 16.6%, and 58.4%, respectively.

Table 3. Fluoride concentrations of tap and bottled water and fluoride intake of the study groups.

Fluor Content	G1	G2	<i>p</i>
Tap water (mg/L)	0.385 ± 0.32	1.46 ± 0.59	0.00
Bottled water (mg/L)	0.057 ± 0.15	0.056 ± 0.20	0.51
F intake (mg/d)	0.789 ± 1.55	2.42 ± 2.65	0.00

Values are means ± SD; F—fluoride; G1—group without DF; Student *t*-test for independent samples, Mann–Whitney U test, significance level $p \leq 0.05$.

The estimated F intake of G1 (0.789 ± 1.55 mg/d) was significantly different ($p < 0.05$) compared with G2 (2.42 ± 2.65 mg/d). With respect to the recommended F intake for men (4 mg/d) and women (3 mg/d) [18], 24% of the G2 participants had an elevated F intake, 69% low, and 7% adequate, while, in G1, the proportion was 0%, 97%, and 3%, respectively (Table 3).

4. Discussion

We studied two groups of participants from northwest Mexico—G1 without DF and G2 with DF—and analyzed their BMD of the lumbar spine, femur neck, and total femur, and their actual F intake. Participants from G1 had lived in the southern areas of the town since childhood, while G2 participants had spent all their lives in the northern area of the town, where tap water was naturally fluorinated with high F concentrations 30 years ago.

The current F content of the tap water from the northern area, where G2 participants live, exceeded by 2.5 fold the F concentration for regions with hot climates, and more than 50% of the samples were higher even than the limit set by the Mexican norm (1.5 mg/L). In contrast, only one of the samples used by G1 participants in the south surpassed the acceptable F levels. During the dental development stage of the participants of G2 (20–30 years ago), the F levels in the tap water in some of the northern neighborhoods were

up to 7.82 mg/L [6]. Nowadays, the F content in the water has decreased to 1.46 mg/L (mean) in these places, according to what we were able to detect.

Although F-containing water prevents dental caries [2], its consumption should be monitored to avoid the risk of F accumulation in teeth, bones, thyroid, kidney, and other organs [3]. We found that 74% of the G2 participants had scores from questionable to mild DF, despite the tap water exceeding the F-containing limits for very dry weather. Colombian schoolchildren drank water with a medium fluoride level of 10.5 mg/L and 86.1% of them presented with DF, more frequently with a mild score [5]. In São Paulo, Brazil, 58.9% of 12-year-old children had DF, principally in a very mild form, in municipalities with oscillating F levels in water (0.3–1.2 ppm) and hot weather [19]. In Australian children aged 8–12 years exposed to high F levels in water from birth to age 3, the DF prevalence was 1.86 higher than in those exposed less [20]. Therefore, daily fluoride intake during tooth development can lead to DF.

To explain the mild DF in our G2 group with the high F content in the tap water in early age stages, there are additional conditions to the F intake. The bioavailability of F decreases by forming insoluble compounds with calcium or aluminum [9]. Thus, DF is the combination of the low consumption of Ca and high consumption of F, which results in a higher risk of fluorosis. At bone levels, the severity of skeletal fluorosis and bone deformity is greater in individuals with low dietary Ca intake; therefore, dietary recommendations to prevent the accumulation of F in bones and teeth to maintain appropriate Ca intake are encouraged [21]. Our participants were adults with a current average Ca intake that reached only 55% of the recommended level. The consumption of Ca could have been adequate during childhood because its high Ca content is typical of the daily dishes consumed compared with a westernized diet. Then, the effect of water with a high F content could have been attenuated during the teeth-forming years of the participants of G2, inducing less aggressive DF.

Additionally, there is the possibility of an association between genetic factors and fluorosis, since differences in its risk have been found in persons living under the same conditions [22]. In the Tunisian population, it was found that there was a strong association of COL1A2 (rs 412,777) polymorphism in the COL1A2 gene with DF, and, while the A genotype was protectant, the C, AC, and CC genotypes increased the risk of DF [23].

With respect to the advanced effects of F intake on BMD of G2 with DF, we did not find an association when measured in bone regions (except between questionable DF and total femur). This could be related to a more acceptable F content in the tap water in some neighborhoods years ago when 5 out of 42 participants with such degrees of DF were children. Currently, the consumption of bottled water, either exclusively or in combination with tap water, resulted in a low or adequate intake of F in most of our participants. Due to changes in habits in recent years, the use of 20 L bottled water in-house is very important and its F content is very low, although its use is related to the presence of parasites or other contaminants in the tap water. Additionally, the consumption of commercial gas-containing beverages with very low F content is quite high in our population; people drink them instead of water.

A study of 23-year-old participants agrees with our results with respect to BMD. The authors evaluated the longitudinal fluoride intake since childhood and concluded that typical levels of fluoride intake in the U.S.A. do not harm the developing skeleton [24]. In a cross-sectional study with children and adolescents aged 8–19 years, also from the U.S.A., the results were less clear. Fluoride concentrations in water and plasma were inversely associated with BMD, with their dose–response relationships exhibiting a non-linear trend [25].

In this way, if F exposure is reduced to adequate levels, the F deposited in the bones is released during the bone turnover process and is excreted in the urine, which leads to a decrease in osteosclerosis by fluorosis [26]. In our study, the actual average F intake was found suitable for men and women. This condition may explain why BMD of the lumbar spine, femur neck, and total femur of group G2 with DF was comparable to the BMD values of the participants without DF in group G1. In our population, most of the fluoride comes from water and beverages prepared with naturally fluoridated water as coffee. Our population does not usually drink tea and other foods or beverages with more than 0.04 mg/serving. Our interest in diet was due to Ca sources.

Finally, we had limitations in our study, principally due to financial resources and time. In a future study in the same area, it will be interesting to analyze the urinary F concentrations, F in 24 h urine, and F excretion of our participants. Also, it could be important to include more tissues for BMD, such as tibia and radius, and if possible, to include ultrasound as a quantitative non-invasive assessment of F-associated alterations.

5. Conclusions

There was no association between DF and the measured BMD to infer skeletal fluorosis in the studied adults with dental fluorosis (G2) from NW Mexico. The BMD of the lumbar spine, femur neck, and total femur evaluated was no different between group G2 with dental fluorosis and group G1 without dental fluorosis. The result could be related to low or adequate F intake due to moderate F levels in the current tap water, and the partial or total consumption of bottled water processed by reverse osmosis, which reduces the F content.

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Informed Consent Statement: Informed consent was obtained from all participants in this study.

Data Availability Statement: Data is unavailable due to privacy of the participants as it is stated in the informed consent signed by them.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Pontigo-Loyola, A.P.; Mendoza-Rodriguez, M.; de la Rosa-Santillana, R.; Rivera-Pacheco, M.G.; Islas-Granillo, H.; Casanova-Rosado, J.F.; Márquez-Corona, M.d.L.; Navarrete-Hernández, J.d.J.; Medina-Solís, C.E.; Manton, D.J. Control of Dental Caries in Children and Adolescents Using Fluoride: An Overview of Community-Level Fluoridation Methods. *Pediatr. Rep.* **2024**, *16*, 243–253. [[CrossRef](#)] [[PubMed](#)]
2. Choubisa, S.L. A brief review of fluoride-induced bone disease skeletal fluorosis in humans and its prevention. *J. Pharm. Pharmacol. Res.* **2024**, *7*, 1–6. [[CrossRef](#)]
3. González-González, R.; Bologna-Molina, R.; Molina-Frechero, N. Editorial: Fluoride exposure, dental fluorosis, and health. *Front. Oral. Health* **2023**, *4*, 1256495. [[CrossRef](#)] [[PubMed](#)]
4. Secretaría de Salud. *NOM-201-SSAI-2015, Productos y Servicios. Agua y Hielo Para Consumo Humano, Envasados y a Granel. Especificaciones Sanitarias*; Diario Oficial de la Federación: Mexico City, México, 2022.

5. González-Martínez, F.; Gómez-Scarpetta, R.; Salcedo, O.B.; Bermúdez-Reyes, P.; Castro-Villamizar, P.; Cerezo, M.P.; Martínez, C.; Tirado-Amador, L.; Salas-Zambrano, A.; Saldarriaga, A.; et al. Enamel fluoro sis related with fluoride-containing water ingestion and urinary excretion in schoolchildren. *J. Clin. Exp. Dent.* **2024**, *16*, e51–e61. [CrossRef] [PubMed]
6. Grijalva, M.I.; Valenzuela, A.I.; Silveira, M.I.; Benítez, M.A. La concentración de fluoruros en el agua y su efecto en la salud dental en el estado de Sonora. *Estud. Soc.* **1998**, *3*, 111–134.
7. Khandare, A.; Rao, G.; Balakrishna, N. Dual energy X-Ray absorptiometry (DXA) study of endemic skeletal fluorosis in a village of Nalgonda district, Andhra Pradesh, India. *Fluoride* **2007**, *40*, 190–197.
8. Meterored. Clima en Hermosillo. Available online: <https://www.meteored.mx/hermosillo/historico> (accessed on 12 December 2024).
9. Dean, H.T. The investigation of physiological effects by the epidemiological method. In *Fluoride and Dental Health*; Moulton, R.F., Ed.; American Association for Advancement of Science: Washington, DC, USA, 1942; pp. 23–31.
10. Asociación Mexicana de Agencias de Inteligencia de Mercado y Opinión. Nivel Socioeconómico AMAI 2024, Comité de Nivel Socioeconómico AMAI. Available online: https://www.amai.org/descargas/NOTA_METODOLOGICA_NSE_AMAI_2024_v6.pdf (accessed on 12 December 2024).
11. CDC. About Body Mass Index (BMI). Available online: <https://www.cdc.gov/bmi/about/index.html#:~:text=BMI%20is%20a%20measure%20of,expensive%20and%20not%20widely%20available> (accessed on 10 December 2024).
12. Rush, E.C.; Valencia, M.E.; Plank, L.D. Validation of a 7-day physical activity diary against doubly-labelled water. *Ann. Hum. Biol.* **2008**, *35*, 416–421. [CrossRef] [PubMed]
13. Lorente, R.R.M.; Azpeitia, A.J.; Arévalo, G.N.; Muñoz, H.A.; García, G.J.M.; Gradilla, M.J. Absorciometría con rayos X de doble energía. Fundamentos, metodología y aplicaciones clínicas. *Radiología* **2012**, *54*, 410–423. [CrossRef] [PubMed]
14. American Public Health Association (APHA). *Method 4500-F: Standard Methods for Examination of Water and Wastewater*; American Public Health Association: Washington, DC, USA, 1992.
15. Hernández, M.; Romieu, I.; Parra, S.; Hernández-Avila, J.; Madrigal, H.; Willett, W. Validity and reproducibility of a food frequency questionnaire to assess dietary intake of women living in Mexico City. *Salud Públ. Mex.* **1998**, *40*, 133–140. [CrossRef] [PubMed]
16. Hernández, M.; Resoles, M.; Parra, S. *Sistema de Evaluación de Hábitos Nutricionales y Consumo de Nutrimientos (SNUT)*; Instituto Nacional de Salud Pública: Cuernavaca, Mexico, 2000.
17. *Standard Methods 4500-F- A, B and D*; Determination of Fluoride F- Spectrophotometric Method; Standard Methods for the Examination of Water and Wastewater. 22nd ed. American Public Health Association: Washington, DC, USA, 2012.
18. United States Department of Agriculture: Recommended Intakes for Individuals. 2010. Available online: https://www.nal.usda.gov/sites/default/files/fnic_uploads/recommended_intakes_individuals.pdf (accessed on 1 April 2018).
19. Moimaz, S.A.S.; Saliba, O.; Marques, B.L.; Garbin, S.G.; Saliba, A.N. Dental fluorosis and its influence on children's life. *Braz. Oral. Res.* **2015**, *29*, 1–7. [CrossRef] [PubMed]
20. Do, L.; Miller, J.; Phelan, C.; Sivaneswaran, S.; Spencer, A.J.; Wright, C. Dental caries and fluorosis experience of 8–12-year-old children by early life exposure to fluoride. *Community Dent. Oral. Epidemiol.* **2014**, *42*, 553–562. [CrossRef] [PubMed]
21. Sánchez-Pimienta, T.G.; López-Olmedo, N.; Rodríguez-Ramírez, S.; García-Guerra, A.; Rivera, J.A.; Carriquiry, A.L.; Villalpando, S. High Prevalence of Inadequate Calcium and Iron Intakes by Mexican Population Groups as Assessed by 24-Hour Recalls. *J. Nutr.* **2016**, *146*, 1874S–1880S. [CrossRef] [PubMed]
22. Küchler, E.C.; Tannure, P.N.; Oliveira, D.S.; Charone, S.; Nelson-Filho, P.; Silva, R.A. Polymorphisms in genes involved in enamel development are associated with dental fluorosis. *Arch. Oral. Biol.* **2017**, *76*, 66–69. [CrossRef] [PubMed]
23. Kallala, R.; Slimani, A.; Gassara, Y.; Garrach, B.; Chouchen, S.; Foddha, H.; Rouis, A.; Kenani, A. The association between Dental Fluorosis and COL1A2 gene polymorphism among a Tunisian Population. *BMC Oral. Health* **2024**, *24*, 376. [CrossRef] [PubMed]
24. Bhatia, G.K.; Levy, S.M.; Warren, J.J.; Rysavy, O.A.; Saha, P.K.; Zhang, J.; Zeng, E. Associations between longitudinal fluoride intakes from birth to age 23 and multi-row detector computed tomography bone densitometry outcomes at age 23. *J. Public. Health Dent.* **2024**, *84*, 428–438. [CrossRef] [PubMed]
25. Kong, H.; He, Z.; Li, H.; Xing, D.; Lin, J. The Association between Fluoride and Bone Mineral Density in US Children and Adolescents: A Pilot Study. *Nutrients* **2024**, *16*, 2948. [CrossRef] [PubMed]
26. Grandjean, P.; Thomsen, G. Reversibility of skeletal fluorosis. *Br. J. Ind. Med.* **1983**, *40*, 456–461. [CrossRef] [PubMed]

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