

## **Development of a research and innovation network on Fluoride and dental Fluorosis in latin america**

### **Desenvolvimento da rede de pesquisa e inovação em Flúor e Fluorose dentária na américa latina**

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#### **Paola Andrea Mena Silva**

PhD in Odontología

Institution: Universidad Regional Autónoma de los Andes

Address: Km 5 1/2 vía, Baños - Ambato, Ecuador

E-mail: pao\_mena100@hotmail.com

#### **Erik Dreyer Arroyo**

Phd, Educación y Sociedad, Facultad de Educación for Universidad de Barcelona, España

Institution: Facultad de Odontología, Universidad de Chile

Address: Sergio Livingstone Paulhamer, 943, Independencia, Chile

E-mail: edreyer@odontologia.uchile.cl

#### **Miguel Neira Jara**

Licenciado en Bioquímica

Institution: Facultad de Odontología, Universidad de Chile

Address: Sergio Livingston Paulhamer 943, Independencia, Chile

E-mail: mneira@odontologia.uchile.cl

#### **Rubén Hugo Ponce**

Doctor en Ciencias Químicas

Institution: Facultad de Odontología, Universidad Nacional de Córdoba

Address: Haya de la Torre S/N, Pabellón Argentina, Ciudad Universitaria, 5000, Córdoba, Argentina

E-mail: ruben.ponce.069@unc.edu.ar

#### **Raquel Vivian Gallará**

Doctor en Ciencias Químicas

Institution: Facultad de Odontología, Universidad Nacional de Córdoba

Address: Haya de la Torre S/N, Pabellón Argentina, Ciudad Universitaria, 5000, Córdoba, Argentina

E-mail: raquel.gallara@unc.edu.ar

**Farith Damián González Martínez**

Doctorado Ciencias Farmaceuticas, Universidad de Cartagena, Facultad de Ciencias Farmacéuticas, Cartagena, Colombia

Institution: Universidad de Cartagena, Colombia

Address: Carrera 50, número 24-120, Campus de la Salud, Universidad de Cartagena, Cartagena, Colombia

E-mail: fgonzalezm1@unicartagena.edu.co

**Heriberto Atanacio Núñez Mendieta**

Doctorado en Ciencias Odontológicas

Institution: Facultad de Odontología, Universidad Nacional de Asunción

Address: Av. España, Asunción, Paraguay

E-mail: heribertonunez@rec.una.py

**Ismael Yévenes López**

Licenciado en Química y Farmacia

Institution: Facultad de Odontología, Universidad de Chile

Address: Sergio Livingston Paulhamer 943, Independencia, Chile

E-mail: iyevenes@odontologia.uchile.cl

**ABSTRACT**

Dental Fluorosis is a growing public health problem in many parts of the world. Dental Fluorosis in the world youngster population is increasing, as it is highlighted in the latest Latin American epidemiological report. There are few studies on fluorosis and its prevalence in the region. These are the basis for the creation of this international network, including Chile, Colombia, Ecuador, Paraguay and Argentina. In these countries there has been a significant increase in Dental Fluorosis, with values between 50% and 60%. A central goal of this network is to understand the “production-consumption source”, environment and the monitoring of systemic fluoride exposure, key to promote the benefits of fluorides and minimize the risks of chronic overexposure, leading to fluorosis. The significant increase in fluorosis in the Latin American region led to the formation of this research network. Its aim is to create a network of research centers in Latin America based on the management of spaces for communication, exchange and generation of knowledge on the subject of fluorides and dental fluorosis, and to generate products that can be used as inputs for public policy in the national health systems of the countries.

**Keywords:** Latin American Network, Fluoride-Fluorosis, public health, children, dental.

**RESUMO**

A Fluorose Dental é um problema crescente de saúde pública em muitas partes do mundo. A Fluorose Dental na população mundial de jovens está aumentando, como é destacado no último relatório epidemiológico latino-americano. Há poucos estudos sobre a fluorose e sua prevalência na região. Estes são a base para a criação desta rede internacional, incluindo Chile, Colômbia, Equador, Paraguai e Argentina. Nesses países, houve um aumento significativo da Fluorose Dental, com valores entre 50% e 60%. Um objetivo central desta rede é compreender a "fonte de consumo de produção", o ambiente e o monitoramento da exposição sistêmica ao flúor, chave para promover os benefícios dos fluoretos e minimizar os riscos de superexposição crônica, levando à fluorose. O aumento significativo da fluorose na região da América Latina levou à formação desta rede de pesquisa. Seu objetivo é criar uma rede de centros de pesquisa na América Latina baseada

na gestão de espaços de comunicação, intercâmbio e geração de conhecimento sobre o tema de fluoretos e fluorose dentária, e gerar produtos que possam ser utilizados como insumos para políticas públicas nos sistemas nacionais de saúde dos países.

**Palavras-chave:** Rede Latino-Americana, Fluoride-Fluorose, saúde pública, crianças, odontologia.

## 1 INTRODUCTION

Dental Fluorosis can be limited or prevented by following the recommendations on exposure to fluoride, identifying as risk factors: drinking water with high fluoride content, fluoridated salt, fluoride supplements, toothpastes and multiple intake by systemic routes<sup>1</sup>. There is an increase in the prevalence of Dental Fluorosis in the world and particularly in Chile<sup>2</sup> and Colombia<sup>3,4</sup>. Both countries have national fluoridation programs, Chile in water and Colombia in salt. In both countries there has been a significant increase in Dental Fluorosis, with values for Chile over 53% and for Colombia over 60%. Additionally, Ecuador does not have national data on the prevalence of Dental Fluorosis. Nevertheless, Armas-Vega et al. (2018)<sup>5</sup> studied children between 10 and 12 years of age from three provinces of Ecuador and found prevalence values of 89.6%, with grade 2 IFT being the most frequent<sup>5</sup>. Also, in Paraguay, the National Survey on Oral Health (2008)<sup>6</sup>, for enamel fluorosis, showed that it was not a Public Health concern. But studies (2003 and 2011) in 12-year-old children found percentages of fluorosis up to 45.2% and 50%<sup>7,8</sup>. In Argentina there are no massive fluoridation programs and no official reports of fluorosis. Argentina has endemic areas of fluorosis with values above 80% prevalence in some areas of the country<sup>9</sup>. These facts, and the unsuccessful history of finding a cause for this anomaly, led us to develop this network of fluoride and fluorosis in the Latin American region, whose purpose is to create and share knowledge around the potential causes behind the increase in prevalence of fluorosis in our countries.

This proposal of the Latin American Network of Fluorides and Dental Fluorosis is the first in Latin America capable of integrating researchers from different countries with experience in its approach, so that objectives with greater complexity are achieved through permanent collaboration. This is necessary because in the last 50 years the information on exposure to fluorides has generated widespread evidence not sufficiently considered by countries in this part of America, despite having the highest prevalence globally. Sources of systemic fluoride intake have been identified as those with the highest risk. However, the impact of diet on fluorides is still unknown. Also, the use of

urinary fluoride excretion as a biomarker for monitoring total intake of fluoride needs further development<sup>10,11</sup>.

Total fluoride intake has been suggested as the most important risk factor for the development of Dental Fluorosis. These intakes include diet (water and fluoridated salt, foods and beverages prepared with artificially or naturally fluoridated water), and non-dietary intake. Dental Fluorosis can be prevented by following the recommendations (Den Beste, 2011)<sup>12</sup> to avoid exposure to fluorides, identified as risk factors: drinking water with high fluoride content, fluoride supplements, toothpastes and multiple intake by systemic routes. It is important for dentists and health professionals to use fluoride correctly and to advise their patients, since various products contain it, so they should give their own recommendations about concentration, frequency of use and dosage schedule<sup>13</sup>.

The lack of knowledge on the total intake of fluoride and the certainty that dental fluorosis is increasing brings us to say that all the countries in this network show increases in fluorosis. This reality and the failure to carry out joint work to find the causes of this anomaly resulted in the development of this network of fluoride and fluorosis in Latin America, whose purpose is to know and inform important factors (such as: intake of fluorides in children from 0 to 12 months, impact of regionalism on the appearance and increase of fluorosis). However, few studies on the subject have been conducted in our countries. The general objectives raised by the generation of this network are the creation of research centers in Latin America, the management of spaces for communication, exchange and generation of knowledge on fluorides and dental fluorosis, to generate products that can be used as inputs within public policy in the health systems of the countries.

## **2 MATERIAL AND METHODS**

Gather expert researchers on the subject from different countries to the network. At the IADR-LAR (Uruguay 2018), presentations on Fluorides from Colombia (Farith González) and Chile (Ismael Yévenes) laid the groundwork for the first meeting to form an international collaboration group on the subject of Fluorides and Dental Fluorosis. The first face-to-face meeting of researchers from Chile, Colombia, Ecuador, Paraguay and Argentina was held in Santiago (Chile) at the Faculty of Dentistry of the University of Chile, on August 6, 2019. Several researchers from Chile, Farith González from Colombia and Heriberto Núñez from Paraguay participated in this meeting, while

researchers from Ecuador and Argentina were unable to attend and formally excused themselves by letter. The topics discussed were: 1. Presentation of the University of Chile project entitled “Generation of Interdisciplinary Research Networks for Global Challenges”. 2. Presentation of the proposal of the University of Cartagena for the creation of the collaboration network on the subject of fluorides and Dental Fluorosis. 3. Presentation of opportunities for participation in financing funds for international networks. 4. Current description of Dental Fluorosis in Chile, Colombia and Paraguay. The following commitments were approved: 1. Search for resources through international calls for financing networks. 2. Creation of face-to-face and virtual interaction tools between members of the network to promote and strengthen visibility and permanent communication. 3. Development of knowledge dissemination strategies through academic and social appropriation events. 4. Generation of mobility among the members of the network to strengthen expertise in the subject. 5. Formulation and execution of multicenter research projects. 6. Generation of a dialogue with the health authorities of the countries to reach global agreements that lead to a reformulation of the public policy for the use of fluorides with greater safety and efficacy.

The second meeting was held virtually (organized from Colombia) on July 10, 2020, with the participation of researchers from the different countries of the network. The objective of this meeting was to follow up on the commitments made at the first meeting held in Chile and to show the products of the network for it to be a benchmark on the subject in Latin America. The topics raised were: 1. Write in collaboration a book in Spanish about fluorides and Dental Fluorosis. 2. Write literature review articles on the subject. 3. Organize virtual academic sessions that include webinars and forums. 4. Promote approaches with the Ministries of Health of the countries to impact the public policy guidelines on fluorides and Dental Fluorosis. The proposals approved were; 1. Presentation of book chapters and distribution at the next meeting. 2. Engaging students in literature reviews that could complement the information in the book. 3. Academic conferences by country when the book is finished (the second semester of 2021 is proposed). 4. Approaches with the Ministries of Health of the countries and promotion of meetings for future interactions.

During the 3rd virtual meeting on October 28, 2020 (Colombia), with the attendance of all the participants, the following topics were discussed: 1. Follow-up on the book about Fluorides and Fluorosis: a) distribution of the chapters of the book according to the decision of each researcher, considering their level of expertise. b)

Format of the book, writing standards, length and editorial conditions, as well as target public. c) Search for international publishers interested in this publication.

At the 4th virtual meeting on June 30, 2021 (Colombia) attended by all the participants. Network projects were monitored; 1. Advance of the book with the responsibility assumed by the co-authors in each chapter. 2. Participation in writing a research project for the "IADR Latin American Region Award" Contest. 3. Participation in webinars or forums to socialize the chapters of the book. 4. Consultancies with the Ministry of Health of Colombia. Approved proposals: 1. To complete the missing chapters of the book, a deadline was set for Friday, July 30. 2. Friday, July 16, deadline to review the network project that will participate in the IADR-LAR award. 3. The webinars would start in October 2021 and the first ones would be coordinated by the National University of Asunción. 4. Meeting with the Ministry of Health of Colombia, where it was proposed that the network searched for evidence and generated a proposal on the effects of the addition of fluorides in vehicles such as salt, as well as its interactions with iodine. This meeting was scheduled for August 11, 2021. On that occasion, the need to incorporate researchers from Brazil and Uruguay into the network was reiterated.

### 3 RESULTS AND DISCUSSIONS.

Currently the network is made up of the following academics. See table 1.

Table 1. Academics of the Network for Research and Innovation in Fluoride and Dental Fluorosis in Latin America.

Academic Name	Country	University	Faculty	Profession	Academic degree
Ismael Yévenes	Chile	University of Chile	Dentistry	Pharmaceutical chemist	Bachelor's degree
Ana del Carmen Armas Vega	Ecuador	Central University of Ecuador	Dentistry	Dentist	Master and PhD Dental Materials
María del P. Barahona Salazar	Chile	University of Chile	Dentistry	Dentist	Master in Health Administration.
Erik Dreyer Arroyo	Chile	University of Chile	Dentistry	Dentist	PhD Education and Society
Mario Diaz Dosque	Chile	University of Chile	Dentistry	Chemist	PhD Engineering Sciences
Rubén Hugo Ponce	Argentina	National University of Cordoba	Dentistry	Biochemist	PhD Chemical Sciences
Raquel Vivian Gallará	Argentina	National University of Cordoba	Dentistry	Biochemist	PhD Chemical Science
Farith D. González Martínez	Colombia	University Cartagena	Dentistry	Dentist	PhD Environmental Toxicology
Ketty Ramos Martínez	Colombia	University Cartagena	Dentistry	Dentist	Master in Public Health

Lizelia Alfaro Zolá	Colombia	University Cartagena	Dentistry	Dentist	Master in Dental Sciences
Francisco Javier Sir Mendoza	Colombia	University Cartagena	Dentistry	Dentist	Master's Student in human genetics
Guillermo Enrique Tamayo Cabeza	Colombia	University Cartagena	Dentistry	Dentist	Doctoral student
Paola Andrea Mena Silva	Ecuador	Autonomous Regional University of the Andes	Dentistry	Dentist	PhD Dentistry
Marco Antonio Cornejo Ovalle	Chile	University of Chile	Dentistry	Dentist	PhD Biomedicine
Miguel Neira Jara	Chile	University of Chile	Dentistry	Biochemist	Master in University Teaching
Anunzziatta Fabruccini	Uruguay	University of the Republic	Dentistry	Dentist	PhD Dentistry
Judith Liberman	Uruguay	University of the Republic	Dentistry	Dentist	PhD Dentistry
Heriberto Núñez.	Paraguay	Universidad Nacional de Asunción.	Dentistry	Dentist	PhD Dentistry
Andrea Muñoz	Chile	University of Chile	Dentistry	Dentist	Master in Public Health

All academics mentioned in Table 1 have contributed to the development and growth of this research network on fluorides and fluorosis. However, due to editorial regulations only 8 will appear as authors, but all are authors of this publication.

To date, the following competitive projects have been submitted: 1. Contest for the generation of interdisciplinary research networks for global challenges VID 2018. Project to strengthen state universities UCH-1799. With the proposal "Research and Innovation Network for Dental Fluorosis in Latin America". 2. "IADR REGIONAL DEVELOPMENT" Contest 2020, in its "Letter of Intent" and "FULL PROPOSAL" stages with the proposal "Total fluoride intake from food prepared with fluoride water and urinary excretion of fluoride in children from 0 to 4 years from Colombia, Chile, Ecuador and Paraguay". 3. "IADR Latin American Region" Award for Multi-country Projects between two or more Divisions and/or Sections of LAR, with the proposal to be submitted on August 9, 2021. The project presented for the "IADR Latin American Region" award entitled: "Estimation using the microdiffusion technique of the daily intake of fluoride in children from 0 to 6 months in Colombia, Chile, Ecuador, Paraguay, Argentina and Uruguay" 4. In addition, the research project "Estimation of the average daily intake of fluorides in children from 0 to 12 months in the Metropolitan Region, Chile, 2022, was presented as a personal project on April 8, 2021. This is because by regulation it was not possible to participate as a group to the XVIII National Competition of Research and Development Projects in Health FONIS 2021, dependent on the ANID



(National Research and Development Agency) Chilean government agency. The summary of research projects prepared by the members of the network and submitted to different contests is shown in table 2.

Table 2. Projects developed by the network and postulate

Name of the application	Country	Year of application	Proposal Name	Application Result
Contest for the generation of interdisciplinary research networks for global challenges VID 2018. Project to strengthen state universities UCH-1799.	Chile	2018	"Research and Innovation Network for Dental Fluorosis in Latin America".	Accepted for execution without financing
IADR Regional Development" Contest 2020. Stages: "Letter of Intent" and "Full Proposal"	USA	2020	"Total fluoride intake from food prepared with fluoride water and urinary excretion of fluoride in children 0 to 4 years of age from Colombia, Chile, Ecuador and Paraguay".	Letter of Intent accepted and Full Proposal. Not accepted
"IADR Latin American Region" Award for Multi-country Projects between two or more Divisions and/or Sections of LAR	Uruguay	2021	Estimation using the microdiffusion technique of the daily intake of fluoride in children from 0 to 6 months in Colombia, Chile, Ecuador, Paraguay, Argentina and Uruguay"	Not funded
XVIII National Competition of Research and Development Projects in Health, FONIS 2021	Chile	2021	"Estimation of the average daily intake of fluorides in children from 0 to 12 months in the Metropolitan Region, Chile, 2022".	Project approved with financing for 2022, 2023 and 2024

Within the socialization activities of the network's products, a series of webinars began in the different countries in the second half of 2021, Paraguay being the first. The



participating speakers would be the same members of the network and the assistant professors and students from Latin American Universities. Likewise, in 2022, symposiums and refresher courses on the subject and the first international congress are planned. Also, the mass media and social networks will be used to disseminate the advances in knowledge on this subject. We also had a presence at international congresses, such as presentations at the XI OdontoHemisferios Congress in Ecuador and also at the V Extensao da AUGM Congress in Brazil.

Included in the strategies for disseminating knowledge of the network is the preparation of a book in Spanish on fluorides and Dental Fluorosis. A book of 7 chapters prepared by multidisciplinary teams of the network to be finished at the end of 2022. We consider it important to give presence and visibility to the network by implementing talks with health entities from the countries participating. Academics from Colombian universities organized a meeting with the Colombian Ministry of Health who asked us 3 questions about massive fluorides, to which we gave a written answer. These responses were subsequently discussed in a larger meeting and the document issued by the network will be used by the Ministry as a basis for future public policies. These activities carried out by the Network for Research and Innovation in Fluoride and Dental Fluorosis in Latin America are summarized in Table 3.

Table 3. Knowledge dissemination strategies on fluorides and fluorosis developed by the network.

Event	Date	Country	Speakers/Actions	Event Name
CEMIT UNA Disclosure Day	July 22, 2021	Paraguay	Prof. Dr. Rubén Hugo Ponce Prof. Dra. Raquel Vivian Gallará Prof. Dr. Heriberto Núñez	Chronic Fluoride Exposure and Fluorosis
CEMIT UNA Disclosure Day	August 17, 2021	Paraguay	Prof. Ismael Yévenes	Determination of Fluoride in Biological Samples
Presentation in the V Congress of Extensao da AUGM	13-15 November 2021	Brazil	Cartagena University, Colombia. Equinoctial Technological University, Ecuador. Cordoba National University, Argentina. National University, Paraguay. University of Chile, Chile	Development of a Network for Research and Innovation in Fluoride and Dental Fluorosis in Latin America
Meeting with the Ministry of Health of Colombia	August 11, 2021	Colombia	Network academics. Colombian Ministry	Consultation MINSAL Colombia on: Fluoride-iodine interaction

				Fluoride values in massive vehicles. Systemic fluoride and skeletal fluorosis.
Scientific disclosure. Preparation of a book	Ongoing	All the countries of the network	Academics of the universities participating in the network	Book about fluorides and fluorosis in Spanish. In preparation, publication date: end of 2022

FOLA (Latin American Dental Federation)<sup>10</sup> in its "Symposium on Fluoride and Fluorosis in Latin America", 2016, points out: The discussion about the relationship between fluoride and dental fluorosis must take place in a comprehensive manner, given the responsibility of the states in the health of the general population. Public health entities, territorial governments, decentralized governments and the scientific community must participate.

Mission: The Latin American Network for Research in Fluorides and Dental Fluorosis is a space for inter-institutional academic-scientific cooperation, focused on the study of the causality of dental enamel Fluorosis, identifying the main sources of exposure to Fluorides in the different countries, with the purpose of generating knowledge, exchanging information, sharing resources and contributing to the generation of new intervention models for this relevant dental health problem.

#### 4 FINAL CONSIDERATIONS

The sustainability of the network over time requires international recognition and funding (IADR, CYTED Call), state funding in the case of Chile, mainly through FONIS or similar funds associated with oral health problems; in the case of Colombia through competitive funds from Colciencias and for the other countries, by means of National Contests.

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