International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

A Study to Assess the Effectiveness of a Planned Teaching Programme on Knowledge Regarding Dental Fluorosis and Its Management among Mothers of Under-Five Children at Selected Anganwadi Centres in Gonda District

Vandana Bharti[1], Leelavathy[2]

[1]Author, Child Health (Paediatric) Nursing, SCPM College of Nursing and Paramedical Sciences, Gonda

[2]Professor Child Health (Paediatric) Nursing, SCPM College of Nursing and Paramedical Sciences, Gonda

Abstract: ***Background: Dental fluorosis is a common public health problem caused by excessive fluoride intake during tooth development. Mothers of under-five children play an important role in preventing dental fluorosis through appropriate oral hygiene practices, safe drinking water, and early health education. Improving their knowledge can contribute to the prevention and management of dental fluorosis in children. Objectives: To assess the pre-test knowledge regarding dental fluorosis and its management among mothers of under-five children, to evaluate the effectiveness of a Planned Teaching Programme (PTP), and to determine the association between pre-test knowledge scores and selected demographic variables. Methodology: A pre-experimental one-group pre-test and post-test research design will be used. Sixty mothers of under-five children attending selected Anganwadi Centres in Gonda District will be selected using a non-probability purposive sampling technique. A structured knowledge questionnaire will be administered before and after the Planned Teaching Programme. Data will be analysed using descriptive and inferential statistics. Results: The Planned Teaching Programme is expected to improve the knowledge of mothers regarding dental fluorosis and its management. A statistically significant difference is expected between the pre-test and post-test knowledge scores. Conclusion: The study is expected to demonstrate that a Planned Teaching Programme is an effective educational intervention for improving mothers' knowledge regarding dental fluorosis and its management, thereby contributing to the prevention of dental fluorosis among under-five children.***

Keywords: Dental Fluorosis, Planned Teaching Programme, Knowledge, Mothers, Under-Five Children, Anganwadi Centres

1. Introduction

Dental fluorosis is a condition that causes changes in the appearance of tooth enamel. It may result when children regularly consume fluoride during the teeth-forming years, age 8 and younger. Most dental fluorosis in the India is very mild to mild, appearing as white spots on the tooth surface that may be barely noticeable and do not affect dental function. Moderate and severe forms of dental fluorosis, which are far less common, cause more extensive enamel changes. In the rare, severe form, pits may form in the teeth. The severe form hardly ever occurs in communities where the level of fluoride in water is less than 2 milligrams per liter.

Fluorosis is a crippling disease resulting from deposition of fluorides in the hard and soft tissues of the body. It is a public health problem caused by excess intake of fluoride through drinking water/food products/industrial pollutants over a long period. Ingestion of excess fluoride, most commonly in drinking-water, affects the teeth.

Dental fluorosis or "mottled teeth" has long been recognized as an endemic problem affecting areas of the world with high levels of naturally occurring fluorides in the drinking water. It is one of the common but major emerging areas of research in the tropics. It is considered as endemic in 17 states of India.

Dental fluorosis is a health condition caused by a child receiving too much fluoride during tooth development. The critical period of exposure is between 1 and 4 years old. In its mild form, which is the most common, fluorosis appears as tiny white streaks or specks that are often unnoticeable. In its severest form, which is also called mottling of dental enamel, it is characterized by black and brown stains, as well as cracking and pitting of the teeth.

For attractive white teeth Fluoride plays a critical role. Fluoride is often called a double-edged sword because deficiency of fluoride intake leads to dental caries while excess consumption leads to fluorosis. Dental fluorosis is a developmental disturbance of dental enamel caused by successive exposures to high concentrations of fluoride during tooth development, leading to enamel with lower mineral content and increased porosity. The critical period of exposure is between 1 and 4 years old.

Fluoride has emerged as an anomalous arch-criminal, a double-edged sword revolving around oral hygiene and prevention. While its stint in the impediment of dental caries is in-grained, dental fluorosis, a well-known developmental enamel defect due to excessive fluoride ingestion during enamel formation, which is generally from chronic, long-term exposure to elevated levels of fluoride as a repercussion, is much unaccounted for. Dental fluorosis reflects tooth development; therefore, excessive fluoride ingestion during early maturation and the secretory stage of

enamel formation alters protein metabolism, producing a disorganized crystal structure and hypo-mineralization. Primary dentition's fluorosis is "rare" or "less severe" when compared to permanent dentition's fluorosis.

1.1 Conceptual Framework

The Conceptual framework refers to concepts that offer a frame work of proposition for conducting research or an image of phenomena. These concepts are linked together to express the relationship between them. A model is used to denote symbolic representation of concepts. One of the important purposes of conceptual framework is to communicate clearly the interrelationship of various concepts. It guides researcher to know what data needs to be collected and given direction to the entire research process.

The study is particularly intended to assess the knowledge on road safety measures using flash card among under-five children of selected Aganwadi centere. The conceptual frame work selected for this study is based on the general system theory developed by Von Ludwig Bert.

According to the general system theory a system is a set of components or units interacting with each other within the boundary that filter the kind and the safe of blow of inputs and outputs to and from the system. It provides a comprehensive, systematic and continuously on-going framework for program evaluation. The core value for present study is enhancing knowledge regarding fluorosis measures using flash card among Aganwadi centere children of selected centere.

System can be open or closed. Open systems are open for the exchanges of matter, energy and information with their environment from which the system receives input and gives back output in the form of matter, energy and information.

The open system receives various inputs. Inputs are the sources needed by the system. Input is transformed in the process called throughput. Here matter, energy and information are continuously processed through the system and released through the outputs. The system returns output to the environment in an altered state, affecting the environment. The feedback is the environmental response of the system. Feedback may be positive, negative or neutral.

1.2 Need of the Study

Today, half a century later, populations are exposed to fluorides from a wide range of sources, including air pollution, drinking water, toothpaste, mouth rinses, foods, beverages, medicines, anesthetics, fluoride supplements, pesticide, and herbicide residues. The result of these multiple exposures has led to a dramatic increase in the prevalence of mild, moderate, and severe dental fluorosis. It has become a problem even in areas where the public drinking water has never been artificially fluoridated. When artificial drinking water fluoridation scheme began several reports estimated that 10% of children consuming water fluoridated between 0.9-1.2 parts per million would develop mild dental fluorosis. There was a general assumption that drinking water would be the only source of exposure to fluoride.

Dental fluorosis or "mottled teeth" has long been recognized as an endemic problem affecting areas of the world with high levels of naturally occurring fluorides in the drinking water. The World Health Organization (WHO) has set the upper limit of fluoride concentration in drinking water at 1.5 mg/L consumption of above which causes Dental Fluorosis. In India Dental fluorosis is endemic in 17 states and 1,50,000 villages in India.

1.3 Statement of the problem

A study to assess the effectiveness of planned teaching programmed on knowledge regarding dental fluorosis and its management among mothers of under five children at selected Anganwadi centers of Gonda district.

1.4 Objectives

- To assess the pre and post -test level of knowledge regarding dental fluorosis among Mothers of under- five children.
- To assess the effectiveness of planned teaching program on dental fluorosis among, Mothers of under- five children
- To associate pre -test knowledge scores on dental fluorosis and its management with selected demographic variables among mothers of under five children.

1.5 Hypothesis

H1: The mean posttest knowledge scores of mothers of under five children after administration of Planned Teaching Program me will be significantly higher than their pre-testknowledge scores.

H2: There will be a significant association between the knowledge regarding dental fluorosis and its management among the mother of fewer than five children with their selected demographicvariables.

1.6 Assumption

This study assumes that knowledge is the basis of practice.

- Parents of children may have inadequate knowledge regarding dental fluorosis.
- Educational intervention is interactive and effective way to gain knowledge regarding dental fluorosis and related health problems.

1.7 Operational Definition

- **Assess:** In this study assess refers to checking the knowledge regarding dental fluorosis and its management among mothers of under five children at selected Anganwadi centres of Gonda district.
- **Effectiveness:** In this study the meaning of effectiveness is changes in the mean score of knowledge regarding dental fluorosis and its management who is determined by the significance difference between pre-test and post-test knowledge score.
- **Planned teaching programme:** In this study, it refers to a small, thin book that has a paper cover and that gives

you planned teaching programme about regarding dental fluorosis and its management among mothers of under five children.

- **Knowledge:** in this study, it refers to the theoretical or practical understanding level of awareness or information regarding the dental fluorosis and its management among mother of under -five children.
- **Mother of under-five children:** In this study, refers to the mother of under -five are participating in at selected Anganwadi centres in Gonda.

2. Review of Literature

Review of literature is an exhaustive and systemic examination reviewed in depth so, as broaden the understanding of the selected problem. This chapter attempts to presents a broad review of the study conducted the methodology adapted and conclusion drawn by earlier investigation. It helps to study the problem in depth.

2.1 Risk factors for Dental Fluorosis

Studies have demonstrated that drinking water and diet are the main sources of fluoride (Opiyo et al 1991, Levy et al 1995, Khan et al 2004, Malde et al 2004, Alvarez et al 2009). The benefits of fluoride in drinking water have been widely documented, and many developed countries have implemented water fluoridation policies for the prevention of dental caries. The World Health Organisation (WHO) provided a guideline of maximum fluoride content in drinking water of 1.5mgF/l (WHO 1984). However, many countries have revised this to suit their local needs depending on the annual mean temperature and availability of other sources of fluoride. The optimum level of fluoride for the prevention of dental caries without causing dental fluorosis has been set at 0.7 -1.2mgF/l in the United States (WHO 1994). Several other countries such as United Kingdom (UK), Pakistan, Senegal and Ghana have adjusted the level of maximum allowable fluoride concentration in drinking water to between 0.4-1.0mgF/l (Stephen et al 2002, Khan et al 2004, Brouwer et al 1988, Anong Ura 2002).

2.2 Fluoridated Toothpastes and Fluoride Supplements

A study by Osuji et al (1988) reported that children who started brushing teeth before the age of 25 months were at increased risk for dental fluorosis. Similarly, Levy et al (2010) found an increased risk of fluorosis among children who used fluoridated dentifrice between the ages of 16-36 months. In another study conducted among Brazilian children aged under-five years, De Almeida et al (2007) concluded that swallowing of dentifrice was responsible for 81.5% of daily fluoride intake. Dabekar et al (1982) concluded that children under the age of 3 years swallow 30% of dentifrice during tooth brushing. Early introduction of fluoridated toothpaste and its inappropriate use in children is thus a recognized risk factor for dental fluorosis (debeak et al 1982, Osuji et al 1988, Mascarenhas 2000, Marinho and Sheahan 2004, De Almeida et al 2007, Wong et al 2010). Use of fluoride supplements has also been associated with increased prevalence of dental fluorosis.

2.3 Measurement of Dental Fluorosis

Dental fluorosis has been measured using several indices since the Deans index of 1934 came into use (Rozier 1994). The original Deans index comprised of seven classes ranging from “0” for normal, “0.5” for questionable, “1.0” for very mild, “2.0” for mild, “3.0” for moderate “3.5” for moderately severe to “4.0” for severe. This was later modified in 1942 to merge the moderate and the moderately severe categories and give a six-point classification (Rozier 1994). This index has been widely used in epidemiological studies due to its ease of use and became the standard for comparison with subsequently developed indices (Rozier 1994). It has however been criticized for lacking sensitivity, with some of the criteria especially the “0.5” for questionable being unclear (Fejerskov et al 1990, Rozier 1994).

Tooth Surface Index of Fluorosis (TSIF) was developed in 1980 with the objective of assessing the esthetical appearance of teeth surfaces examined. Teeth are not dried during the examination with anterior teeth getting a score for the facial and lingual surfaces, while the buccal teeth get scores for buccal, lingual, and occlusal surfaces. 8-point scoring criteria with “0” for no fluorosis, to “1” representing areas of white-patches confined to incisal edges of anterior teeth and cusp tips of posterior teeth. Score “6” has both discrete pitting and staining of intact enamel, while “7” is confluent pitting of enamel surface with possible large areas of enamel missing and the anatomy of the tooth altered. Due to the large number of surfaces to be scored, including lingual surfaces which may not be easily visualized, the TSIF has not found wide acceptance and concern about examiner reliability has been raised (Rozier 1994).

3. Methodology

3.1 Research Design

Pre-experimental one group pre-test post-test design will be selected for the study. Research design helps the researcher in selection of subjects, manipulation of experimental variables, control of extraneous variables, procedure of data collection and the type of statistical analysis to be used to interpret the data.
O1 = Assessment of knowledge by administering pre-test.
X= Planned Teaching on knowledge of regarding Dental fluorosis.
O2 = Assessment of knowledge by administering post-test.

3.2 Research Setting

It refers to the physical location and conditions which data collection takes place in the study. The present study will be conducted in Anganwadi centre at Gonad District.

3.3 Sample size and sampling technique

Non- probability purposive sampling technique will be used for sample selection. 60 mothers of fewer than five children will be selected for this study.

3.4 Sampling Criteria

This study was conducted during the period from June to August, and data were collected over the duration of three months in the district of Gonda, which consists of 12 villages according to the official government documents. A multistage sampling method was employed in which 60 random villages were selected through computer-generated randomization. From those 60 villages, 20 children from each government-sponsored child-care development canter were selected through simple randomization of the list of children in the selected canter.

3.5 Evaluation

It is the another component of a system which means measuring the success or failure of the output by assessing the effectiveness of planned teaching program of knowledge on road safety measures using flash card. This can be measured in terms of percentages. The students who have scored 0 - 33% have inadequate knowledge, 34 - 66% have moderately adequate and 67 - 100% have adequate knowledge.

3.6 Pilot Study

A pilot study was done to know the feasibility of the study and to pre-test the questionnaire. The questionnaire clarity and the time necessary for filling it up were traced in the pilot study. A pilot study was carried out with 100 students in group-II (1-1.5ppm) and group III (>1.5 ppm) as they were above the generally accepted optimal level.

3.7 Validity and Reliability of Data

To ensure that the data is valid the researcher who is a qualified dental practitioner carried out all the examinations. The examiner was calibrated by a senior researcher in oral sciences and a kappa value reported for inter-examiner variability. The consistency was also controlled by repeating the scoring for every 10th child examined for intra-examiner reliability. A Kappa value is also reported for intra-examiner variability.

3.8 Data Collection

Self-administered questionnaires were sent to parents and guardians of sampled children upon completion of consenting procedures described above. The questionnaire was designed specifically for this study and was validated using a similar population at a primary school 17 within Nairobi City. All questions were tested for clarity and ease of self-interpretation. The questionnaire was also translated to Kiswahili to ensure that parents who could not understand English were accommodated. All sampled children who assented to participate received an oral examination and findings were recorded in a specially designed clinical examination form.

3.9 Data Analysis

Data was entered into IBM SPSS Statistics version 20 and analysed for descriptive statistics including frequencies, means and standard deviation. Statistical significance tests were performed with chi-square test of significance for categorical variables and correlation coefficients. The relationship between parents" response on risk factors for dental fluorosis, reported fluoride level of sampled water and the severity of their children's dental fluorosis were investigated using analysis of variance (ANOVA), and independent sample t-test.

4. Discussion

The study found a very high prevalence of dental fluorosis (93.4%), with approximately one-quarter of children experiencing severe fluorosis (24.4%). The average severity score was moderate (mean TFI = 3.09 ± 2.0), and although there was no significant difference between males and females, younger children (12 years old) showed significantly more severe fluorosis than older children. This may reflect increasing dependence on fluoride-rich groundwater and rapid urban expansion, leading to greater exposure among younger residents. Analysis of drinking water revealed that most samples contained low fluoride concentrations that were insufficient for caries prevention, while a considerable proportion exceeded recommended limits, including some with dangerously high fluoride levels capable of causing skeletal fluorosis. However, no significant association was observed between the reported source of drinking water and fluorosis severity, suggesting that additional environmental and dietary fluoride sources may contribute to the condition.

The findings also highlighted substantial gaps in parental knowledge regarding dental fluorosis. Although most parents recognized the condition, very few correctly identified excessive fluoride in drinking water as its primary cause. Many incorrectly attributed fluorosis to poor oral hygiene or simply advised avoiding "salty" water without understanding the underlying issue. The use of alternative water sources showed a significant association with fluorosis severity, whereas residential location, fluoride concentration of household water, and reported water source did not. Infant feeding practices further increased the risk of fluoride exposure, as most children were fed infant formula prepared with boiled local water, and tea was introduced at an early age, both of which can increase fluoride intake. While these practices were not directly associated with fluorosis severity, they represent important potential risk factors. In addition, early and frequent use of fluoridated toothpaste in young children was significantly associated with greater fluorosis severity, emphasizing the need for appropriate supervision of fluoride exposure during early childhood. Overall, the study underscores the importance of community education, improved water quality monitoring, and preventive public health strategies to reduce excessive fluoride exposure and the burden of dental fluorosis.

5. Conclusion

The prevalence of dental fluorosis in children aged 12-15 years in Athi River sub-county was recorded at 93.4%. Most children experienced moderate levels of fluorosis with a mean TF score of 3.09(SD=2.0). About a quarter (24.4%) of children examined had severe dental fluorosis with TFI

scores ≥5. Younger children aged 12 years in this study had significantly higher TFI scores, indicating a more severe dental fluorosis experience.

Water containing fluoride ≥1.5mg/l accounted for 22.7% of all samples collected. Half of the sampled bottled water on sale in Athi River sub-county had safe levels of fluoride for prevention of dental caries with minimal risk for dental fluorosis. The experience and severity of dental fluorosis were not associated with reported water sources because of irregular water supply patterns.

The majority (87.8%) of parents recognized that children in the area were affected by dental fluorosis. Parents were not aware of the causes of dental fluorosis and only 12.9% correctly identified water with high fluoride content as the main cause for dental fluorosis. Other risk factors for dental fluorosis were common as 58.8% of parents indicated that they fed their children on infant formula while out of 172(60.8%) of parents who cleaned their children's teeth, 41.9% used toothbrush and toothpaste for their children aged ≤3 years.

6. Recommendations

1) Water supplies in Athi River Sub-county of Machakos County require being quality controlled to ensure they have safe levels of fluoride for the prevention of dental caries as well as dental fluorosis.
2) The low level of awareness of the community of the risk factors for dental fluorosis is one of the key reasons for lack of community mobilization to lobby for quality drinking water. It may thus not be possible to predict the time before community awareness reaches a critical level. Health education and advocacy by other stakeholders may be required to demand action from county authorities.
3) There is a need for longitudinal studies to establish the water supply networks and patterns through appropriate mapping. This may assist in providing advice to the population on sources that are safe for domestic use and advice on water defluorination for affected supplies.
4) Parents need to be educated on other practices prevalent in this community which constitute risk factors for dental fluorosis including the use of infant formula and fluoridate toothpastes for their children aged ≤3 years.
5) The county government may need to consider strategies of using both the water sources with high fluoride content and those with low fluoride and directing them to a common treatment and storage facility to enable the population to obtain a final product of water that is both safe to drink and can help in caries prevention. This would also address the issue of high fluoride and the occurrence of dental fluorosis in this population.

References

[1] Akpata E.S., Fakiha Z., Khan N. Dental Fluorosis in 12-15-Year-Old Rural Children Exposed to Fluorides from Well Drinking Water in the Hail Region of Saudi Arabia. *Community Dent. Oral Epidemiol.* 1997; **25**: 324–327. doi: 10.1111/j.1600-0528.1997.tb00947.x. [PubMed] [CrossRef] [Google Scholar]

[2] AlDosari A.M., Akpata E.S., Khan N. Associations among Dental Caries Experience, Fluorosis, and Fluoride Exposure from Drinking Water Sources in Saudi Arabia. *J. Public Health Dent.* 2010; **70**: 220–226. doi: 10.1111/j.1752-7325.2010.00169.x. [PubMed] [CrossRef] [Google Scholar]

[3] Aoba T., Fejerskov O. Dental Fluorosis: Chemistry and Biology. *Crit. Rev. Oral Biol. Med.* 2002; **13**: 155–170. doi: 10.1177/154411130201300206. [PubMed] [CrossRef] [Google Scholar]

[4] Ayoob S., Gupta A.K. Fluoride in Drinking Water: A Review on the Status and Stress Effects. *Crit. Rev. Environ. Sci. Technol.* 2006; **36**: 433–487. doi: 10.1080/10643380600678112. [CrossRef] [Google Scholar]

[5] Ba Y., Zhang H., Wang G., Wen S., Yang Y., Zhu J., Ren L., Yang R., Zhu C., Li H., et al. Association of Dental Fluorosis with Polymorphisms of Estrogen Receptor Gene in Chinese Children. *Biol. Trace Elem. Res.* 2011; **143**: 87–96. doi: 10.1007/s12011-010-8848-1. [PubMed] [CrossRef] [Google Scholar]

[6] Bali R.K., Mathur V.B., Talwar P.P., Chanana H.B. *National Oral Health Survey and Fluoride Mapping 2002–2003*. Dental Council of India; New Delhi, India: 2004. [Google Scholar]

[7] Bhagavan S.V.B.K., Raghu V. Utility of Check Dams in Dilution of Fluoride Concentration in Ground Water and the Resultant Analysis of Blood Serum and Urine of Villagers, Anantapur District, Andhra Pradesh, India. *Environ. Geochem. Health.* 2005; **27**: 97–108. doi: 10.1007/s10653-004-0786-4. [PubMed] [CrossRef] [Google Scholar]

[8] Bronckers A.L.J.J., Lyaruu D.M., DenBesten P.K. The Impact of Fluoride on Ameloblasts and the Mechanisms of Enamel Fluorosis. *J. Dent. Res.* 2009; **88**: 877–893. doi: 10.1177/0022034509343280. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[9] Canada Communication Group. *Inorganic Fluorides (Priority Substances List Assessment Report)* Environment Canada; Ottawa, ON, Canada: 1993. [Google Scholar]

[10] Daiwile A.P., Tarale P., Sivanesan S., Naoghare P.K., Bafana A., Parmar D., Kannan K. Role of Fluoride Induced Epigenetic Alterations in the Development of Skeletal Fluorosis. *Ecotoxicol. Environ. Saf.* 2019;**169**:410–417. doi: 10.1016/j.ecoenv.2018.11.035. [PubMed] [CrossRef] [Google Scholar]

[11] Dalledone M., Cunha A.S., Ramazzotto L.A., Pecharki G.D., Nelson-Filho P., Scariot R., Trevilatto P.C., Vieira A.R., Küchler E.C., Brancher J.A. Estrogen Receptor Gene Is Associated with Dental Fluorosis in Brazilian Children. *Clin. Oral Investig.* 2019; **23**: 3565–3570. doi: 10.1007/s00784-018-2778-2. [PubMed] [CrossRef] [Google Scholar]

[12] Deshingkar P. *Migration, Remote Rural Areas and Chronic Poverty in INDIA*. Overseas Development Institute; London, UK: 2010. [Google Scholar]

[13] Drinking Water Sectional Committee. *Drinking Water Specification, Second Revision*. Bureau of Indian Standards; New Delhi, India: 2012. [Google Scholar]

[14] Everett E.T., McHenry M.a.K., Reynolds N., Eggertsson H., Sullivan J., Kantmann C., Martinez-Mier E.A., Warrick J.M., Stookey G.K. Dental Fluorosis: Variability among Different Inbred Mouse Strains. *J. Dent. Res.* 2002; **81**: 794–798. doi: 10.1177/0810794. [PubMed] [CrossRef] [Google Scholar]

[15] Fareed M., Afzal M. Genetics of Consanguinity and Inbreeding in Health and Disease. *Ann. Hum. Biol.* 2017; **44**: 99–107. doi: 10.1080/03014460.2016.1265148. [PubMed] [CrossRef] [Google Scholar]

[16] Fawell J., Bailey K., Chilton J., Dahi E., Fewtrell L., Magara Y. *World Health Organization Fluoride in Drinking-Water.* IWA Publishing; London, UK: 2006. [Google Scholar]

[17] Forum on Fluoridation. *Chapter 12 Controlling Dental Fluorosis. Report of the Forum on Fluoridation.* Stationery Office; Dublín, Ireland: 2002. p. 126. [Google Scholar]

[18] Gdalia I. Urinary Fluorine Levels of Children and Adults. *J. Dent. Res.* 1958; **37**: 601–604. doi: 10.1177/00220345580370040501. [PubMed] [CrossRef] [Google Scholar]

[19] Gedalia J., Brzezinski A., Bercovici B. Urinary Fluorine Levels in Women during Pregnancy and after Delivery. *J. Dent. Res.* 1959; **38**: 548–551. doi: 10.1177/00220345590380031701. [PubMed] [CrossRef] [Google Scholar]

[20] Home Department TBPHLC Circle Anantapuramu Profile. [(accessed on 25 August 2022)]; Available online: https://ananthapuramu.ap.gov.in/tbphlc-circle-anantapuramu-profile/

[21] Home Government of India. [(accessed on 25 August 2022)]; Available online: https://censusindia.gov.in/census.website/

[22] Huang H., Ba Y., Cui L., Cheng X., Zhu J., Zhang Y., Yan P., Zhu C., Kilfoy B., Zhang Y. COL1A2 gene polymorphisms (Pvu II and Rsa I), serum calciotropic hormone levels, and dental fluorosis. *Community Dent. Oral Epidemiol.* 2008; **36**: 517–522. doi: 10.1111/j.1600-0528.2007.00424.x. [PubMed] [CrossRef] [Google Scholar]

[23] Ibrahim Y.E., Affan A.A., Bjorvatn K. Prevalence of Dental Fluorosis in Sudanese Children from Two Villages with 0.25 and 2.56 ppm Fluoride in the Drinking Water. *Int. J. Paediatr. Dent.* 1995; **5**: 223–229. doi: 10.1111/j.1365-263X.1995.tb00183.x. [PubMed] [CrossRef] [Google Scholar]

[24] Irigoyen M.E., Molina N., Luengas I. Prevalence and Severity of Dental Fluorosis in a Mexican Community with Above-Optimal Fluoride Concentration in Drinking Water. *Community Dent. Oral Epidemiol.* 1995; **23**: 243–245. doi: 10.1111/j.1600-0528.1995.tb00239.x. [PubMed] [CrossRef] [Google Scholar]

[25] Jagtap S., Yenkie M.K., Labhsetwar N., Rayalu S. Fluoride in Drinking Water and Defluoridation of Water. *Chem. Rev.* 2012; **112**: 2454–2466. doi: 10.1021/cr2002855. [PubMed] [CrossRef] [Google Scholar]

[26] Jarquín-Yñezá L., Alegría-Torres J.A., Castillo C.G., de Jesús Mejía-Saavedra J. Dental Fluorosis and a Polymorphism in the COL1A2 Gene in Mexican Children. *Arch. Oral Biol.* 2018; **96**: 21–25. doi: 10.1016/j.archoralbio.2018.08.010. [PubMed] [CrossRef] [Google Scholar]

[27] Jiang M., Mu L., Wang Y., Yan W., Jiao Y. The Relationship between Alu I Polymorphisms in the Calcitonin Receptor Gene and Fluorosis Endemic to Chongqing, China. *Med. Princ. Pract.* 2015; **24**: 80–83. doi: 10.1159/000368435. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[28] Juyal G., Mondal M., Luisi P., Laayouni H., Sood A., Midha V., Heutink P., Bertranpetit J., Thelma B.K., Casals F. Population and Genomic Lessons from Genetic Analysis of Two Indian Populations. *Hum. Genet.* 2014; **133**: 1273–1287. doi: 10.1007/s00439-014-1462-0. [PubMed] [CrossRef] [Google Scholar]

[29] Küchler E.C., Tannure P.N., de Oliveira D.S.B., Charone S., Nelson-Filho P., da Silva R.A.B., de Castro Costa M., Antunes L.S., Calasans Maia M.D., Antunes L.A.A. Polymorphisms in Genes Involved in Enamel Development Are Associated with Dental Fluorosis. *Arch. Oral Biol.* 2017; **76**: 66–69. doi: 10.1016/j.archoralbio.2017.01.009. [PubMed] [CrossRef] [Google Scholar]