

# Prevalence Of Dental Caries, Dental Fluorosis And Its Correlation With Fluoride Levels In Drinking Water Among 12 To 15 Years Old School Going Children Of Sivakasi Taluk, Virudhunagar District, Tamilnadu, India.

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**Abstract:** *Aim: The Aim Of The Study Is To Find Out The Prevalence Of Dental Caries And Dental Fluorosis And Its Correlation With Drinking Water Fluoride Levels Among 12 To 15 Years Old School Going Children Of Sivakasi Taluk, Virudhunagar District, Tamilnadu. Materials And Method: A Cross-Sectional Study Was Conducted Among 12 To 15 Years Old School Going Children Of Sivakasi Taluk, Virudhunagar District, Tamilnadu. A Total Of 1320 Study Subjects Were Clinically Examined At The School By Calibrated Examiner With Dean's Fluorosis Index And Dentition Status Who (2013) And 72 Groundwater Sample Analysis Was Also Done. Chi-Square Test And Pearson Correlation Were Used For Statistical Analysis. Results: The Overall Dental Fluorosis And Dental Caries Prevalence Was Found To Be 61.7% And 54.6% In Our Study Sample. Correlation Between Fluoride Content In Drinking Water And Community Fluorosis Score In School Students Showed A Strong Positive Correlation. A Negative Correlation Was Noted Between Fluoride Concentration In Drinking Water And Mean Dmft Score. Conclusion: In The Present Study, The Data That Is Presented Is Based On The Areas That Had A History Of High Fluoride Levels Which Lack Monitoring And Data Updates. This Study Has Concluded That Though The Fluoride In The Water Level Is Optimum Or Below Optimum, The History Of High Fluoride And Its Effects On The Oral Health Of The Population Still Prevails.*

**Key-Words:** *Virudhunagar District, Dental Fluorosis, Water Fluoride Level, Dental Caries.*

## 1. INTRODUCTION:

The World Health Organization (Who) Report And Other Studies Suggest Dental Caries To Be A Major Public Health Problem In Most Of The Developing Countries, Affecting 60-90% Of The School Children In Spite Of The Declining Trends In The Most Developed Countries

(1,2). The Decline In Dental Caries Among Children In Highly Developed Countries Started To Emerge Around 1970 And The Percentages Of Caries Free Children In Different Age Categories Have Increased Since Then. This Was Mainly

Attributed To The Increased Use Of Fluorides From All Sources, Especially Toothpastes (3,4).

India Is One Among The 25 Nations Around The Globe, Showing Increasing Trends In Dental Caries. The School Children In India Have The Dual Problems Of Dental Caries And Dental Fluorosis. The Endemic Fluorosis Areas In India Cover Around 17 States. Many Laboratories, Clinical And Dental Public Health Researchers Have Concluded After More Than 70 Years Of Research That, Fluoride Is A Double-Edged Sword. Its Deficiency Leads To Dental Caries And Excess Consumption In The First 5-10 Years Of Life Leads To Dental Fluorosis (5). The Fluorides Produce A Dose-Dependent Effect On The Dentition. However, This Is Not Confined To Increased Caries Resistance. Fluoride Causes Various Disorders, Together Called As Fluorosis, If Accumulated Above Certain Levels In The Body. According To A Who Report "It May Not Be Possible To Achieve Effective Fluoride Based Caries Prevention Without Some Degree Of Dental Fluorosis." Public Health Administrators Must Seek To Maximize Caries Reduction, Whereas Minimizing Dental Fluorosis. The Literature On The Relation Between Fluoride Concentration In Drinking Water With Dental Caries Is Conflicting. Some Studies Reveal An Inverse Relation (6,7) While Others Found No Relation (8) Or A Positive Association (9,10)

The State Of Tamilnadu Is One Such Severely Affected Endemic Fluoride Belts In The Country. Fluorosis Is One Amongst The Public Health Problems Which Is Mainly Because Of Increased Ingestion Of Fluoride Through Drinking Water (11). As Ground Water Is The One Important Source For Drinking Water, Fluoride Level In The Ground Water Should Be Considered And Controlled To Reduce The Fluorosis And Protect The Teeth Against Dental Caries. Fluoride Level In The Ground Water Varies From One Area To Another And From Superficial Layer To The Deeper Layer On The Earth. Sivakasi Taluk Which Is One Among The 11 Taluks In Virudhunagar District, Tamilnadu Is An Endemic Fluoride Area With Fluoride Concentration In Drinking Water Ranging From Below Optimum To Optimum And Above Optimum Levels. This Study Assumed Hypothesis That There Is No Correlation Between Dental Caries And Dental Fluorosis In Relation With Drinking Water Fluoride Levels Among 12 To 15 - Years Old School Going Children Of Sivakasi Taluk, Virudhunagar District, Tamilnadu.

The Aim Of The Study Is To Find Out The Prevalence Of Dental Caries And Dental Fluorosis And Its Correlation With Drinking Water Fluoride Levels Among 12 To 15 Years Old School Going Children Of Sivakasi Taluk, Virudhunagar District, Tamilnadu.

## **2. MATERIALS AND METHOD:**

A Cross Sectional Study Was Conducted Among 12 To 15 Years Old School Going Children Of Sivakasi Taluk, Virudhunagar District, Tamilnadu During The Month Of April 2018 To May 2018. The Nature And Purpose Of The Study Was Explained To The Institutional Review Board Of Srm Dental College Ramapuram And Ethical Clearance Was Obtained. Prior To The Start Of The Study, Water Sample From 72 Villages In Sivakasi Taluk Was Collected By The Examiner Himself. The Source Of Water Supply Must Be The Most Common Source Used By Most Of The Residents Of The Village. The Collected Water Samples Were Sent To Analysis For Fluoride Ion Content On The Same Day To The District

Water Testing Laboratory Located At Virudhunagar. Fluoride Is Determined Potentiometrically Using Ion Selective Electrode Method. The Study Participants Were Identified Using Multistage Cluster Random Sampling After The Water Analysis.

The Inclusion Criteria For This Study Includes Only Children Aged 12 To 15 Years Of Age, School Children Who Were Lifelong Residents In That Region And Who Were Using One Source Of Drinking Water From Birth To At Least 8 Years Of Their Life, Children With All Permanent Teeth, Except Third Molars, With At Least More Than 50% Of The Crown

Erupted. The Exclusion Criteria Include Children With Orthodontic Brackets Were Excluded As This Hindered Diagnosis Of Enamel Defects, Children With Severe Extrinsic Stains On Their Teeth In Whom Assessing Fluorosis Was Not Possible, Children With Severe Calculus And Plaque. Children's Whose Informed Consent Was Denied By Their Parent/Guardian.

A Pre-Designed Structured Questionnaire Was Used To Collect The Desired Information On Demographic Status, Materials Used For Brushing, Brushing Frequency, Source Of Drinking Water, Place/Location Of Living From Birth To 8 Years Old, History Of Usage Of Fluoride Tablets/Toothpaste Any Other, History Of Fluorosis In Family Members, Oral Hygiene Practices. Questionnaire Was Filled By The Investigator By Means Of Face To Face Interview To Avoid Misinterpretation Of Questions And To Ensure Uniformity In Data Collection. Dental Caries In 12-Year-Old School Children Was Assessed By Who Proforma, 2013 For Children And Who Proforma, 2013 For Adults Was Used To Assess Dental Caries In 13, 14 And 15 Years Old Children. Dental Fluorosis Was Assessed By Using Dean's Dental Fluorosis Index, 1942. The Clinical Examination Was Carried In The School Premises Under Natural Day Light On The Plastic Chair After Obtaining Informed Consent From The Children's Parents. According To Who Specification, Type Iii Examination With Mouth Mirror, Explorer Was Conducted Under Bright Natural Light, By Positioning The Subject As To Receive Sufficient Day Light.

The Data Recorded Was Analysed Using Spss Software. The Prevalence Of Dental Caries And Dental Fluorosis Was Compared Using Pearson's Chi-Square Test. Spearman's Rho Was Used To Correlate Fluoride Concentration With Dental Caries And Dental Fluorosis.

### 3. RESULTS:

The Present Study Was Done To Find Out The Prevalence Of Dental Caries And Dental Fluorosis And Its Correlation With Drinking Water Fluoride Levels Among 12-15-Year-Old Children. A Total Of 1320 School Going Children Were Enrolled In The Study.

Table 1: Distribution Of Study Population According To Age In Different Fluoride Zones

Sl.No	Age In Years	Fluoride Zones			Total
		Low	Optimal	High	
1	12	98	117	116	331
2	13	116	121	113	350
3	14	137	110	109	356

4	15	89	92	102	283
Total		440	440	440	1320

Chi Square Value= 7.588; P = 0.270 ;Df=6

Table 1 Shows The Distribution Of Study Participants According To Their Age In Different Zones. Students Aged 14 Were More In Number I.E. 356 Amongthe Study Population. [X<sup>2</sup> = 7.588;P=0.270 ]

Table-2: Number Of Decayed Teeth Among Study Population

Sl.No	No. Of Decayed Teeth	Frequency Among Study Group	Percentage
1	0	532	40.3
2	1	372	28.2
3	2	264	20.0
4	3	90	6.8
5	4	46	3.5
6	5	6	0.5
7	6	7	0.5
8	8	1	0.1
9	9	1	0.1
10	10	1	0.1
	Total	1320	100.0

Chi Square Value= 29.238; P = 0.046 (Significant);Df=18

Table 2shows The Number Of Decayed Teeth Among The Study Population. Out Of 1320 Study Participants, 532 Participants Were Caries Free And 788 Were Caries Positive. Among The 788, 372 Participants Had One Decayed Tooth, 264 Participants Had Two Decayed Teeth, 90 Participants Had Three Decayed Teeth, 46 Participants Had Four Decayed Teeth, 6 Participants Had Five Decayed Teeth, 7 Participants Had Six Decayed Teeth, 1 Participant Had Eight Decayed Teeth, 1 Participant Had Nine Decayed Teeth, 1 Participant Had Ten Decayed Teeth.

**Table-3: Number Of Missing Teeth Among Study Population**

Sl.No	No. Of Missed Teeth	Frequency Among Study Group	Percentage
1	0	1308	99.1
2	1	9	0.7
3	2	3	0.2
	Total	1320	100.0

**Chi Square Value= 8.371; P = 0.030 (Significant) ;Df=6**

Table 3 Shows The Number Of Missing Teeth Among The Study Population. Out Of 1320 Students Participated In The Study, 1308 Students Did Not Have Any Missing Teeth. 9 Participants Had One Missing Tooth And 3 Participants Had 2 Missing Teeth. Among The Study Population, 1308 Participants Does Not Have Any Missing Teeth. [ $\chi^2 = 10.740$ ;  $P = 0.030$  (Significant)]

**Table-4: Number Of Filled Teeth Among Study Population**

Sl.No	No.Of Filled Teeth	Frequency Among Study Group	Percentage
1	0	1294	98.0
2	1	14	1.1
3	2	10	0.8
4	3	2	0.2
	Total	1320	100.0

**Chi Square Value= 8.371; P = 0.030(Significant) ;Df=6**

Table 4 Shows The Number Of Filled Teeth Among The Study Population. Out Of 1320 Students Participated In The Study, 1294 Students Did Not Had Any Filled Teeth. 14 Participants Had One Filled Tooth And 10 Participants Had 2 Filled Teeth And 2 Participants Had 3 Filled Teeth. Among The Study Population, 1308 Participants Does Not Have Any

Missing Teeth. [ $\chi^2 = 10.740$ ;  $P = 0.030$  (Significant)].

Table-5: Distribution Of Decayed, Missing And Filled Teeth According To Fluoride Zones

Sl.No		Fluoride Zones			Total (% Within Group)
		Low (% Within Group)	Optimal (% Within Group)	High (% Within Group)	
1	No. Of Participants With Decayed, Missing Or Filled Teeth	297(67.5)	243(55.2)	274(62.3)	814(61.7)
2	No. Of Participants With No Decayed, Missing Or Filled Teeth	143 (32.5)	197 (44.8)	166 (37.7)	506 (38.3)

Table 5 Shows The Distribution Of Decayed, Missing Or Filled Teeth According To Fluoride Zones. 297 Participants Out Of 440, 243 Participants Out Of 440 And 274 Participants Out Of 440 Had Either Decayed, Missing Or Filled Component In Low, Optimal And High Fluoridated Zones Respectively. In This Study, The Students Residing In The Low Fluoridated Areas Had The High Prevalence Of Dental Caries I.E. 297 Participants (67.5%) Among 440 In The Group. [ $\chi^2 = 14.120$ ;  $P = 0.001$  (Significant)].

Table-6: Distribution Of Dental Fluorosis According To Fluoride Zones

Sl.No		Fluoride Zones			Total
		Low (% Within Group)	Optimal (% Within Group)	High (% Within Group)	
1	No. Of Participants With Dental Fluorosis	187(42.5)	118(26.8)	417(94.7)	722(54.69%)
2	No. Of Participants Who Did Not Have Dental Fluorosis	253 (57.5)	322 (73.2)	23 (5.3)	598(43.6%)

**Chi Square Value= 27.659 ;  $P=0.000$  (Highly Significant);  $Df=2$**

Table 6 Shows The Distribution Of Dental Fluorosis According To Fluoride Zones. 187 Participants out Of 440, 118 Participants Out Of 440 and 417 Participants out Of 440 Had Dental Fluorosis In Low, Optimal And High Fluoridated Zones Respectively. In This Study, The Students Residing In The High Fluoridated Areas Had The High Prevalence Of Dental Fluorosis I.E. 417 Participants (94.7%) Among 440 In The Group. [ $\chi^2 = 27.659$ ;  $P = 0.000$  (Highly significant)].

Table 7: Correlation Between Dental Caries And Dental Fluorosis Among The Study Population According To Different Fluoride Zones

Sl.No	Fluoride Zones	Mean Dmft Score	Mean Dental Fluorosis Scores
1	Low	1.31	0.118
2	Optimal	0.95	0.073
3	High	1.17	0.233

**Spearman's Correlation Between Fluoride Concentration And Dmft Score: Spearman's  $P = -0.18$ ,  $P: 0.05$ . Dmft: Decayed Missing Filled Teeth.**

Table 7 Shows The Correlation Between Dental Caries And Dental Fluorosis Among The Study Population According To Different Fluoride Zones. The Difference In The Mean Decayed, Missing Or Filled Score Between Different Fluoride Areas Was Statistically Significant [ $P: 0.05$ ]. A Negative Correlation (Spearman's  $P = -0.18$ ) Was Noted Between Dental Fluorosis And Mean Dmft Score.

#### 4. DISCUSSION:

Oral Disorders Can Have A Profound Impact On The Quality Of Life And Contribute To Self-Image And Social Interaction. Dental Fluorosis Is Endemic In 150,000 Villages In India (11). The Range Of Optimum Fluoride Concentration For Community Water Fluoridation Is Suggested To Be 0.7-1.2 Ppm In The Literature (12,13). The Fluoride Concentration Of Less Than 0.7 Ppm Is Less Than Optimal As Per The Above Cited Range. So, The Areas With Less Than 0.7 Ppm Fluoride Concentration Were Considered As Low Fluoride Area. The Areas With Optimal Range (0.7 -1.2 Ppm) Were Considered Under Optimal Fluoride Area. The Areas With More Than Optimal Range (>1.5ppm) Were Considered As High Fluoride Area.

The Prevalence Of Dental Caries Was Found Least In Optimal Fluoride Area Followed By High And Low Fluoride Area And So Does The Mean Dmft Levels. This Clearly suggests That Fluoride In Drinking Water Offer Maximum Protection Against Dental Caries At Optimal Concentration Which Ranges From 0.7 To 1.2 Parts Per Million (Ppm) According To Previously Published Literature. The Fluoride Concentration Below Optimal As Well As Above Optimal Was Found To Be Harmful. A Study By Shekar *Et Al* Among 12 And 15-

Years-Old Children In Nalgonda District, Andhra Pradesh Found The Prevalence Of Dental Caries To Be Highest In Areas Where The Concentration Of Fluoride In Drinking Water Was Less Than 0.7 Ppm Followed By Areas With Fluoride Concentration Of 4.1 Ppm And Above. The Results Of The Present Study Were Consistent With The Findings of This Study (14).

The Overall Prevalence Of Dental Caries Among The Study Population For This Present Study Was Found To Be 61.7%. The Prevalence Was Highest In The Low Fluoride Area (67.5%) Followed By High Fluoride Area (62.3%). The Lowest Prevalence Was In Optimal Fluoride Area (55.2%). The Difference In The Distribution Of Caries In Different Fluoride Areas Was Statistically Significant ( $P = 0.001$ ). There Was A Statistically Significant Difference In The Caries Prevalence Between Optimal Fluoride Area And Others. The Difference Between Optimal And High Fluoride Area Was Less Pronounced Than The Difference Between Optimal And Low Fluoride Area. A Study By Sukhabogijr *Et Al* On 1875 School Children Of 12 And 15 Years Old In Nalgonda District, Andhrapradesh Found The Caries Prevalence Of 43.4%. Another Study By Sukhabogijr *Et Al* On 2000 School Children Of 12 And 15 Years Old In Nalgonda District, Andhrapradesh found The Caries Prevalence Of 45.6%. The Overall Prevalence Of Dental Caries From Some Other Studies Done By Shekar *Et Al* And Dharv *Et Al* Was Found To Be 56.3% And 46.7% Respectively. While Comparing With Two Other Studies Done By Sukhabogijr *Et Al*, The Present Study Found Higher Prevalence Of Dental Caries Than Those Studies (15,16).

The Prevalence Of Dental Fluorosis For The Present study Was Found To Be 54.7%. The Prevalence Of Dental Fluorosis In Low, Optimal And High Fluoride Areas Were 42.5%, 26.8% And 94.7% Respectively. The High Prevalence of Fluorosis Was Found In High Fluoride Area followed By Low And Optimal Fluoride Areas. The Mean Scores Of Dental Fluorosis Was Found High In High Fluoride Area (0.233) Followed By Low (0.118) And Optimal Fluoride Areas (0.073).

The Present Study Found That The Difference In the Mean Dmft Score Between Different Fluoride Areas Was Statistically Significant. A Negative Correlation (Spearman's  $P = -0.18$ ) Was Noted Between Dental Fluorosis And Mean Dmft Score. Another Study Done By Sukhabogijr *Et Al* Found The Difference In The Mean Dmft Score Between Different Fluoride Areas Was Statistically Significant. A Negative Correlation (Spearman's  $P = -0.18$ ) Was Noted Between Fluoride Concentration In Drinking Water And Mean Dmft Score. This Study Was In Perfect Agreement With The Present Study (17).

Another Study By Shekar C *Et Al* Found There Was A Negative Correlation Between Fluoride Concentration In Drinking Water And Mean Dmft Score For the Entire Study Population (Spearman's  $sp = -0.118$ ). Another Study Done By Sukhabogi *Et Al* Found that there was A Negative Correlation Between Fluoride Concentration (Spearman's  $P = -0.078$ ) In Drinking Water And Mean Dmft Score. All These Studies Were In Good Support With Our Current Study (15, 16). The Present Study Reports Dental Fluorosis In The Mixed Dentition On Examining 12 -Year Old School Children. However, Reporting Fluorosis In Mixed Dentition Is Not Very Straightforward. However, Information Furnished In The Present Study Can Be Utilized As Preliminary data.

This Was A Cross Sectional Survey. The Major Risk Factor In The Development Of Dental Fluorosis Is Drinking Water. Dental Fluorosis Develops In An Individual During The Time Of Teeth Calcification And The Fluoride Content Of Water During That Period Is Of Prime Importance. It Is Presumed In This Study That The Fluoride Content Of The Water In Each Area Has Not Changed Over The Last 15 Years.



## 5. CONCLUSION:

The Present Study Found High Caries Prevalence In Low And High Fluoride Areas With Fluoride Concentrations Lesser Than 0.7 Ppm And Higher Than 1.2 Ppm. The Medium Fluoride Area With Optimum Fluoride Concentration (0.7 -1.2 Ppm) Had The Lowest Caries Prevalence. There Was A Positive Correlation Between Fluoride Concentration And Prevalence Of Dental Fluorosis With No Age And Gender Predilection. The Results Strongly Support The Findings Of Previous Studies Conducted In Endemic Fluoride Areas That Increase In The Fluoride Concentration Above Optimal Levels Does Not Offer Additional Benefits In Caries Prevention. But, Instead, Increase The Risk For Dental Fluorosis.

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