Oral Health Status of School-Going Children Aged 12-15 Years in Tiruvallur District, Tamil Nadu- A Cross-Sectional Study

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KEYWORDS
Health, dental fluorosis, oral premalignant lesion, oral health, children.

ABSTRACT:
Introduction and Aim: Oral health can have dire consequences on the physiological and psychosocial aspects of a child's well-being. The prevalence of oral diseases among children varies with region and population subgroups. It is necessary to assess the oral health of children as this epidemiological data will serve as the foundation for developing appropriate preventive and treatment strategies. Hence, the aim of this study was to assess the oral health status of school going children aged 12-15 years in Tiruvallur district of Tamil Nadu, India.
Methodology: This cross sectional study was conducted among 842 children aged 12-15 years who were chosen following a multistage random sampling technique. The oral health status of the children was assessed using Oral Hygiene Index- Simplified (OHI-S), Loe and Silness' Gingival Index (GI), Decayed Missing Filled Teeth (DMFT) index in permanent teeth, and the presence or absence of fluorosis & oral premalignant lesions (OPML). The recorded data was then subjected to statistical analysis.
Results: The prevalence of gingivitis in the population was 53.4%. The highest mean DMFT was seen among males aged 12-13 years (3.20 +/- 3.102) and the least mean DMFT was seen among females aged 14-15 years (2.76 +/-2.67). 1.3% of the population had tobacco pouch keratosis and 10.8% of the population exhibited dental fluorosis.
Conclusion: This study has established that the children of Tiruvallur exhibit poor oral health status. Data from this study can serve as a valuable contributor to the development of oral health initiatives with the ultimate goal being improvement in oral health.

1. Introduction

Worldwide, 3.5 billion people are afflicted with diseases of the oral cavity, which surpasses the combined prevalence of non-communicable diseases that occupy the first five positions on the global chart (1). Oral health and general health are inextricably intertwined with each other, significantly affecting the well-being of an individual, with oral health gaining increasing recognition and importance, on par with general health.

The life course of oral health and its trajectories are dynamic, interact with each other, and cumulatively produce positive/negative health outcomes. Health experiences during childhood and adolescence substantially shape the oral health status of an adult. (2,3). The burden imposed by dental caries and other oral diseases on a child can be significant, leading to pain and detrimental consequences on fundamental processes such as eating, weight gain, growth, sleeping, and quality of life. Absenteeism from school, interference with learning, and school performance are ill effects of dental pain in children. Thus, a healthy oral cavity is a crucial determinant of school readiness (4).

However, social and economic disparities exist in the prevalence and intensity of oral conditions. The oral healthcare needs of disadvantaged children, children with special needs, and children belonging to racial and ethnic minorities are higher than other children. These disparities are of heterogeneous origin relating to affordability, availability, and accessibility of oral health services.

The two most common oral diseases encountered are dental caries and periodontal conditions widely seen across all age groups and populations (5).

Dental caries, impacting about 530 million children globally is characterized by tooth demineralization instigated by the activity of organic acids produced as a byproduct of bacterial food substrate fermentation,

while gingivitis is a condition distinguished by inflammatory changes of the gums resulting in a wide range of symptoms from bleeding, swelling to tooth mobility and bone loss. Both of the above-mentioned diseases ultimately lead to the loss of teeth resulting in disability and handicap, affecting the processes of chewing, swallowing, respiration, phonetics, and smiling (6).

The available literature on the prevalence of oral diseases in India shows a varied picture with its prevalence being very high in some areas and low in some areas. A recent systematic review and meta-analysis concluded that the prevalence of caries in Indian children aged 3-18 years was 52%(7). A study carried out among rural and urban children of Bhopal observed that the prevalence of gingivitis was 59% (8).

Multiple macro and micro-level factors dictate the patterns of oral diseases in a country, one of them being oral health policy. Unfortunately, most countries' policy-making undertakings consistently fail to incorporate oral health into health policies, as oral diseases are viewed as non-life-threatening and insignificant (2). Moreover, the dentist population ratio in India ranges from 1:1000 to 1:20,000 across different states. Every year, about 30,570 dentists are produced in India; however, only a mere 10% of dentists serve the rural people ultimately leading to oral diseases going undiagnosed in some regions.

The lead step to be considered while designing preventive and curative protocols is an elaborate accumulation of epidemiological data and its regional variations and associated factors. This carries relevance as oral health protocols need to be tailored according to varying requirements (9).

However, scarce evidence is available from the state of Tamil Nadu and no such study has been conducted in the district of Tiruvallur.

In line with the aforementioned necessity, this study was undertaken to assess the oral health status of school-going children aged 12-15 years in Tiruvallur district of Tamil Nadu, India.

2. Methodology

An epidemiological cross-sectional study was conducted among school children attending government schools in Tiruvallur district in the month of July 2024. Ethical approval was obtained from the institution's scientific review board. Official permission to conduct the research in the schools was duly obtained from the concerned government authorities. Tiruvallur is a coastal district of Tamil Nadu with a population of 37,28,104 of which 50.32% are males and 49.68% are females.

Sampling and sample size calculation

A multistage random sampling technique was implemented in Tiruvallur district. From the 14 blocks of Tiruvallur district, Kadambathur block was randomly chosen by lottery method. From the 43 village panchayats in Kadambathur block, Ulundai, Perambakkam, Melnallathur, and Eraymanglam were randomly chosen. Students enrolled in government schools in the above-mentioned panchayats, who satisfied the eligibility criteria were chosen for the study until the required sample size was reached.

The sample size was calculated based on a previous study conducted by Sharma et al (5) using GPower software version 3.1.

Inclusion and Exclusion Criteria

Children aged 12-15 years and those whose parent/guardian consented to the study conduction were included in the study. Children with disabilities and systemic illnesses were excluded from the study.

Examiner Calibration

A single pre-trained examiner carried out the oral health status assessment. Assistants were allotted to the examiner to record the data. In order to assess the intra-examiner reliability, 20 children were randomly selected each day from the study population and subjected to re-examination following a minimum of 30 minutes after the first examination. On calculating the Cohen's Kappa statistic, a good reliability score of 0.8 was observed.

Assessment of Oral Health Status

Each school was visited two times a week until all the study participants were examined. The participants

were subjected to American Dental Association (ADA) type III dental examinations to record the Oral Hygiene Index- Simplified (OHI-S), Loe and Silness' Gingival Index (GI), Decayed Missing Filled Teeth (DMFT) index in permanent teeth, and the presence or absence of fluorosis & oral premalignant lesions (OPML). The instruments were sterilized abiding by a rigorous standard protocol.

The GI scoring based on inflammation and bleeding of the gingiva is as follows: 0- Normal gingiva, 1- mild inflammation, 2- moderate inflammation, and 3- severe inflammation. A participant was considered to have gingivitis if he/she had at least 6 teeth or more with a score of two or higher.

Statistical Analysis

The recorded data was entered in an Excel sheet and subjected to statistical analysis in Statistical Package for the Social Sciences (SPSS) software version 23.

3. Result

842 children between the ages of 12 and 15 years were assessed in this study. 254 (30.16%), 205 (24.3%), 184 (23.04%), and 199 (23.63%) children were in the 12 years, 13 years, 14 years, and 15 years category respectively. Overall, the study population encompassed 421 males and 421 females.

For ease of comparison and presentation of results, the population has been split into 12-13 years age group and 14-15 years age group. The gender distribution across the two age groups is presented in **Table 1**.

Table 1: Gender distribution of the study population across age groups

Age group	Gender	N (%)
12-13 years	Male	276 (60.1%)
	Female	183 (39.9%)
14-15 years	Male	145 (37.9%)
	Female	238 (62.1%)

The oral hygiene of the population was assessed using the OHI-S index. In the 12–13-year age group, though a majority of the females (56. 8%, n=104) had fair oral hygiene and a majority of the males had good oral hygiene (54.7%), only 8 females had poor oral hygiene as compared to 58 males who had poor oral hygiene. Inversely, in the 14-15 years age group, though the majority of males had fair oral hygiene (56.6%, n=82) and the majority of females (52.1%, n=126) had good oral hygiene, only 8 males had poor oral hygiene in comparison to 36 females who had poor oral hygiene. The distribution of oral hygiene patterns across the age groups and genders has been presented in **Table 2**, showing a significant difference between the genders concerning oral hygiene.

Table 2: Distribution of oral hygiene patterns across age groups and gender

Age group	OHI-S	Gender N (%)		P value
		Male	Female	
12-13 years	Good	151 (68%)	71 (32%)	0.000
	Fair	67 (39.2%)	104 (60.8%)	
	Poor	58 (87.9%)	8 (12.1%)	
14-15 years	Good	55 (30.4%)	126 (69.6%)	0.000
	Fair	82 (51.9%)	76 (48.1%)	
	Poor	8 (18.2%)	36 (81.8%)	

The periodontal condition of the population has been presented in **Table 3.** The overall prevalence of gingivitis in the population was 53.4 %. A significant difference in the prevalence of gingivitis was observed between males and females in the 14-15 year age group (p=0.026).

Table 3: Prevalence of gingivitis across genders and age groups.

Age group	Gingivitis	Gender N (%)		P value
		Male	Female	
12-13 years	Absent	142 (51.4%)	79 (43.2%)	0.000
	Present	134 (48.6 %)	104 (56.8%)	
14-15 years	Absent	54 (37.2%)	117 (49.2%)	0.000

	Present	91 (62.8%)	121 (50.8%)	

The prevalence of fluorosis in the population is represented in **Table 4**. The overall prevalence of fluorosis in the study population was 10.8% with no significant difference observed between the genders. In the 12-13 years age group, fluorosis was seen in 14.5% and 15.3% of males and females respectively. In the 14-15 years age group, fluorosis was seen in 5.5% and 6.3% of males and females respectively.

Table 4: Prevalence of fluorosis across genders and age groups.

Age group	Fluorosis	Gender N (%)		P value
		Male	Female	
12-13 years	Absent	236 (85.5 %)	155 (84.7 %)	0.893
	Present	40 (14.5 %)	28 (15.3 %)	
14-15 years	Absent	137 (94.5 %)	223 (93.7 %)	0.828
	Present	8 (5.5 %)	15 (6.3%)	

The mean DMFT score across genders and age groups have been presented in **Table 5.** Though males had a higher DMFT than females in both age groups, no significant differences were observed between the genders ($p<0.05$).

Table 5: Comparison of mean DMFT of the study population using Independent T test

Age group	Gender	Mean DMFT	Standard deviation	F	P Value
12-13 years	Male	3.20	3.012	13.277	0.458
	Female	3.01	2.179		
14-15 years	Male	2.81	2.059	4.282	0.858
	Female	2.76	2.671		

The only OPML observed in the population was Tobacco Pouch Keratosis (TPK). The overall prevalence of OPML in the population was 1.3 % (n=11) which was observed entirely in the 14–15-year age group and among males. No OPML was observed among the 12–13-year-old children.

4. Discussion

The steady incline in globalization and urbanization has caused an increase in sugar exposure among children belonging to developed countries, thus resulting in a spike in dental caries prevalence (10). Moreover, dental healthcare services are comparatively lower in developing countries and rural areas than in developed countries and urban areas (11).

This study was conducted among 842 children in Tiruvallur district. Children who were 12-15 years old were chosen for the study, as it covers the two important World Health Organisation (WHO) index age groups.

In the 12-13 years age group, only 8 females had poor oral hygiene as compared to 58 males with poor oral hygiene. In a study conducted in Kerala, 12-15 year old children, the majority (56%) reported poor oral hygiene(12). This could be due to the greater mental inclination of females to give high priority to aesthetics, appearance, and self grooming as well as their relatively higher oral health knowledge as observed in previous literature (13).

Poor oral hygiene ultimately results in gingivitis. Substantially higher levels of gingival inflammation in the absence of plaque deposition are seen during the years of puberty (14). This is explained by the greater affinity for gingival cells possessed by estrogen and testosterone. This biological plausibility is further reinforced by the observations of gingivitis peaking earlier in girls (11-13 years) than in boys (13-14 years) (15). In a study conducted among adolescents in Kerala, the prevalence of gingival bleeding, periodontal pockets, and loss of attachment was 42%, 13.4%, and 2.7% respectively (12). In a study conducted among Chinese adolescents aged 12-15, almost half the population (47.3%) had plaque induced gingivitis (16). The prevalence of gingivitis reported in Rajasthan and Bhopal were 84.3% and 59% respectively (8,17)(18).

Large scale, community based data gathered from the National Health and Nutrition Examination Survey exhibited a disproportionately higher number of men with periodontal diseases compared to women (56.4% vs. 38.4%) (19). Other studies also consistently support a higher prevalence in men. Sex chromosomes influence the immune response and these differences in immune function also affect the oral microbiome. The

oral microbiome along with tobacco use and oral hygiene result in gender disparities with respect to periodontal health (19,20).

In a study conducted in Mathura city, the mean DMFT of 12 year old children was 0.37 +/- 0.79 (21). In a study conducted among 12-year olds in Belgaum city, the mean DMFT among males and females was 2.62 (±2.22) and 2.76(±2.49) respectively with no significant difference observed between the genders (22). In a systematic review conducted to assess the dental caries status of 5,12, and 15 year old children in India, the weighted mean was found to be 2.56±6.508, 2.49±7.78, and, 1.48±3.292 respectively (23). These results align with that of the National oral Health Survey conducted in 2004 in India.

Gender associated oral health behaviors could also be a potential contributor to caries incidence differences. Men have the tendency to use harder toothbrushes, apply excessive force while brushing, are less likely to utilize a recommended fluoride toothpaste and have less adherence to appropriate brushing techniques (19).

On the other hand, certain studies reported a higher prevalence of caries in women which have been justified by the earlier eruption of teeth in girls and hence an early exposure to a cariogenic oral environment, hormonal effects, and genetic predilections such as modifications in the X-linked amelogenin gene (24).

In the present study, the only OPML observed was TPK and its prevalence was 1.3 %. TPK is a state resulting from persistent frictional irritation of smokeless tobacco products against the oral mucosa. In a study conducted among 5000 people in Hazaribagh, 140 individuals were found to have TPK (2.8%). They also concluded that TPK was the most common lesion (60%) seen in smokeless tobacco users(25).

The results from Global Adult Tobacco Survey-2 (GATS 2) have indicated that every third adult in rural India and every fifth adult in urban India consume tobacco in some way or the other. In India, 28.6% (266.8 million) of adults who are 15 years of age or older use tobacco in some way. The prevalence of tobacco usage in men and women are 42.4% and 14.2% respectively (26) .

Tobacco usage is often a pathway to relieve stress and depression, causing a dependency among young people, which is further enhanced by media promotions, peer pressure, and the need for social validation (27). Mental health, in India, is still far from being viewed as integral to optimal general health and is labeled as taboo (28). This study strongly recommends the expansion and strengthening of mental health services at the primary health care level.

In the present study, a prevalence of 10.8% was observed for dental fluorosis. This is in contrast to a study conducted among adolescents in Karnataka, where the observed prevalence was 64.3% (29). On the other hand, a comparatively lower prevalence of 32.6% and 15.8% was recorded in Kerala and Tamil Nadu respectively (30-34) which is in alignment with multiple other studies.

5. Limitations and Future Scope

This study was conducted among children enrolled in public schools only, and hence is not a fully representative sample. Future longitudinal studies with larger sample sizes assessing associated sociodemographic and behavioral factors need to be conducted.

6. Conclusion

This study highlighted the poor oral health status of children enrolled in government schools in Tiruvallur, Tamil Nadu. The findings of this study can be used as a foundation for policy makers, health administrators and professionals to carry out required interventions for improvement of the children's oral health

Conflicts of interest

No conflicts of interest to disclose.

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