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Epidemiology of dental caries among adolescents in Tamil Nadu, India

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Objective: Economic and dietary changes in the Indian state of Tamil Nadu have led to compromised oral health status of the adolescent population. Adequate epidemiological data are not available to address the prevention or treatment needs in this region of India. The aim of this study was to measure the prevalence and severity of dental caries among adolescents of Tamil Nadu, a southern state of India. **Methods:** The study sample included 974 adolescent school students (12–15 years of age) from both rural and urban areas of Tamil Nadu, India. The decayed, missing and filled teeth (DMFT) index of these students was measured using the World Health Organization oral health survey method, in a quantitative cross-sectional study. **Results:** The oral health survey indicated that the prevalence of dental caries among adolescents in rural and urban areas of Tamil Nadu was 61.4%, with an average DMFT score of 2.03. Multiple regression analyses indicated factors such as gender, mother's education, type of school and caste as significant predictors of dental caries. **Conclusion:** Female gender, Scheduled Caste and Tribes attending public schools in rural areas were identified as the more vulnerable populations to be affected by dental caries. Oral health policies should be targeted to these adolescent populations in the Tamil Nadu region.

Key words: *Prevalence of dental caries, severity of dental caries, Thanjavur, Chennai, oral health survey*

INTRODUCTION

The prevalence of dental caries is increasing in developing countries, such as India, because of economic growth and changes in dietary habits. In India, community-based dental-caries prevention has only recently become a priority. The 2002–2003 National Oral Health Survey conducted by the Dental Council of India indicated a dental decay prevalence of 49.8% and a mean decayed, missing and filled teeth (DMFT) index of 2.5 among 12-year-old subjects and of 3.4 among 15-year-old subjects[1]. The World Health Organization (WHO) and the Government of India conducted a more recent multicentric study (in 2007) comparing oral health-care needs in different states of India, but the state of Tamil Nadu was not included in that study.[2] Both private and Government-funded dental university hospitals, which provide free or inexpensive dental treatment, are clustered in urban areas. In addition, under the 'rural healthcare scheme', 22% of primary health centres provide emergency treatment, scaling, filling and extraction, free of charge to all age groups, by a qualified dentist.[3] However, oral health services are not provided in 78% of primary health centres located in rural areas where 65% of the total Tamil Nadu population live.[4]

Numerous studies have been conducted in different districts of Tamil Nadu[5–7] but baseline data were not adequately reported for either the rural or the urban adolescent population, and data were not available on the distribution of dental caries among different caste categories for the adolescent population. Currently, the Tamil Nadu State Government is in the process of developing and strengthening oral health strategies, which includes the addition of dental services to the primary health-care centres in Tamil Nadu. Hence, if this population-based approach to improving the oral health status of Tamil Nadu is to be evidence informed, there is an urgent need to collect baseline and benchmarking data for this purpose.

The primary aim of this study was to determine the prevalence and severity of dental caries among the Tamil Nadu adolescent population to help inform the implementation of effective intervention and oral

health-prevention strategies. A secondary aim was to determine the differences in the severity and prevalence of dental caries relative to different sociodemographic variables, such as gender, parent's education and caste/community groups (for which very little information is available in the literature).

METHODOLOGY

The primary aim was addressed in a quantitative cross-sectional study, in which the DMFT index was measured using the WHO Oral health survey method. The study sample (adolescents 12–15 years of age) was recruited from subjects in private and public schools in urban and rural areas of Tamil Nadu. The primary aim of the current study was to measure the prevalence and severity of dental caries in an adolescent population. In the present Indian education system, students 16 years of age and over will take common examinations and most school administrations did not provide permission to access these students. Therefore, students ≥16 years of age and those with mixed dentition were excluded from the survey, which resulted in a sample of adolescents 12–15 years of age. A two-stage stratified random-sampling procedure was adopted for the current study. The schools were stratified according to area (rural and urban) and, within a given area, the number of schools was selected by simple random sampling, which was determined by the number of schools in the selected area. The rural participants were recruited from the Thanjavur district and the urban participants were recruited from the city of Chennai.

The participants from the urban population were recruited by selecting five zones from 15 zones in Chennai. The total number of wards in those 15 zones were listed separately and first ward from each zone was selected and then private and public schools in each ward were listed and every fifth school in the list were approached for permission to recruit participants. In the Thanjavur district, the schools in three revenue divisions, namely Thanjavur, Kumbakonam and Pattukottai, were listed and schools in the urban agglomeration were not included in the list. Every fifth school in the list was approached for permission to recruit participants and eight schools in the rural areas agreed to participate in the survey, but only four of the eight randomly selected schools in Chennai district agreed to participate in the dental survey.

Students from the selected schools were invited to participate in the survey and were provided with consent and information sheets. Every student invited to participate in the survey consented to participate (i.e. there were no refusals) and hence the participation rate was 100%. If, after consenting, the students did not meet the inclusion criteria, their data were removed. About 54 survey forms from 12- and 13-year-old subjects who had a mixed dentition were removed.

As it was anticipated that the majority of adolescents would not have had a dental examination whilst living in rural Tamil Nadu, it was therefore considered a fair, ethical and equitable practice to examine every student in the selected class. In the current study, 91% of participants reported that they had never been to a dentist or had undergone any oral health examination previously.

The procedure used in the multicentric oral health survey[2] for the selection of classrooms within each school was also followed in the current study. If there was only one section for that age group, that class was included in the survey. If more than one section was in the required age group, a random selection method was used to select the section to be examined.

Sample size was determined using the formula ($n = Z^2P\ [1-p]/d^2$), where the level of confidence (Z), expected prevalence (p) and precision (d) were input into the formula. The conventional level of confidence (Z = 1.96) was chosen to present the results as a 95% confidence interval (95% CI). The estimated prevalence rate was not known and therefore 0.5 was used for the calculation as a conservative estimate of the prevalence rate because it produced the largest sample needed for the study. To obtain a narrow confidence interval (good precision), d was 0.05. The estimated sample size was 392 and was rounded up to 400. Hence, it was decided to recruit 400 participants from rural and urban areas separately.

Each statistical test (such as the *t*-test, normal curve test, chi-square test, analysis of variance [ANOVA] and multiple regression test) has its own population effect size (ES). It was proposed to undertake a regression analysis and therefore the sample required for multiple regression analysis was calculated based on Cohen's table.[8] In the current research, there were seven independent variables. According to Cohen's table, the sample size needed for a test with seven variables was 726 (ES = 0.02; power = 0.80; significance criterion $\alpha = 0.05$), but the final sample included 974 participants who were examined in the survey. The decision, for ethical and practical reasons, to include all students from selected classes in the survey resulted in oversampling and increased the power of the study. The unexpected lack of refusal to participate had the same effect.

The oral examination was performed by following the procedures recommended in *Oral Health Surveys, Basic Methods 4th edition-World Health Organisation*.[9] The WHO oral health assessment form, modified by the WHO-HQ[10] for the *Multi-Centric Oral Health Survey*, was used for the oral health survey.

The modifications were undertaken in consultation with Professor Poul Erik Peterson, WHO, Geneva. This manual was a simplified version of *WHO Oral Health Surveys, Basic Methods*. The components in the modified oral health assessment form were: survey identification; extra-oral examination; dentition status and dental caries; periodontal status and loss of attachment; oral mucosa; and enamel fluorosis. A self-administered questionnaire was distributed to participants before the oral health examination to collect sociodemographic data, such as gender, age, father's and mother's education and community caste. There was some missing data on community caste but this information was received from teachers.

The DMFT index was used to calculate the prevalence and severity of dental caries. Dental caries in permanent teeth were recorded as present when: a lesion was identified in a pit and fissure or on a smooth surface; there was a noticeably softened floor; a lesion was present in tooth with temporary filling; or in a tooth with permanent filling and also detectable caries was present; and root stumps left and caries to be ascertained as emerged from the crown. Oral health examinations were conducted solely by the clinician (AV) to maintain consistency in the oral examinations. Two in-house dental surgeons were recruited to assist the clinician in organising and recording data during the survey. The oral examination was conducted following appropriate WHO guidelines.

The data were analysed using the Statistical Package for the Social Sciences (SPSS version 20; IBM Corporation, Armonk, NY, USA). First of all, descriptive analyses were undertaken to determine the prevalence and severity of dental caries, and then bivariate and multivariable analyses were conducted to understand the effects of different sociodemographic variables on the prevalence and severity of dental caries.

The research was conducted in full accordance with the World Medical Association Declaration of Helsinki. Ethical approval for the study was received from the Human Ethics Committee, University of Canterbury, New Zealand, and from the Institutional Review Board, Sree Balaji Dental University, Tamil Nadu. The project required approval from the school management, head teachers and parents to access students. Written informed consent was obtained from the parents and the adolescent participants separately, before undertaking the oral examination.

RESULTS

In total, 974 participants, 12–15 years of age, were recruited from six private and six public schools in two districts of Tamil Nadu.

The results indicated that the sample population was representative of the Tamil Nadu population for the categories of caste and parent's education.[4] The male population and 14-year-old subjects were slightly over-represented. Tamil Nadu education statistics indicates that there are more boys than girls both at primary and upper primary levels, which explains the over-representation of male participants in the sample. Participants who had mixed dentition (an exclusion criterion in this study) were mostly among the 12- and 13-year-old subjects. A higher school drop-out ratio among the 15-year-old subjects, especially female students, resulted in over-representation of 14-year-old students and male students in the study.

The prevalence and severity of dental caries were calculated and analysed separately to understand the effect of socio-demographic variables on dental caries.

The prevalence of dental decay was measured in adolescents who had dental caries with a DMFT score of > 0. The results indicated that 61.4% ($n = 598$) of adolescents were affected by dental caries, that is, one out of three adolescents did not have any caries, which included decayed teeth, missing teeth as a result of decay and filled teeth. Frequency analysis indicated that the prevalence of dental caries was higher for adolescents who were 14 years of age, whose father's and mother's education was below the 8th standard, who were female and who belonged to the community group Scheduled Caste and Scheduled Tribes. The Pearson chi-square analysis indicated a strong, statistically significant, correlation between all sociodemographic variables and the prevalence of dental caries. The age of the participants was not associated with the prevalence of dental caries (*Table 1*).

A binary logistic multiple regression analysis (*Table 2*) was performed to understand the predictors of dental caries among different sociodemographic variables by creating a dichotomous binary variable based on those who had DMFT > 1 and who did not have dental caries experience (DMFT = 0). The results (*Table 2*) indicate that the caste and the type of schools were the major predictors of prevalence of dental caries. The odds ratios suggested that the Most Backward Caste and Scheduled Caste/Tribes participants were 1.081 and 1.793 times more likely, respectively, to be affected by dental caries when compared with the Backward Caste. The public school participants were 1.696 times more likely to develop dental caries compared with private school participants.

The severity of decay was measured according to the mean DMFT value (scored between 0 and 32), with a higher value indicating a higher disease severity. The mean DMFT score for the total sample was 2.03 with a standard deviation of 2.30 and median of 1. The total number of teeth affected by dental caries was 1980 in the total sample, and 98.6% of affected teeth were decayed and needed treatment. Only 21

Table 1 Prevalence percentage and mean decayed, missing and filled teeth (DMFT) score associated with different sociodemographic variables

Category	Frequency	Prevalence of dental caries in adolescents		DMFT score	
		n (%)	χ^2(p)	Mean	SD
Total sample	974 (100)		2.03	2.30	
Gender					
Male	542 (55.6)	317 (58.5)	4.364 (0.037)*	1.76	2.12
Female	432 (44.4)	281 (65.0)		2.39	2.50
Age					
12 years	23 (2.4)	12 (52.2)	1.802 (0.615)	1.57	1.93
13 years	224 (23.0)	133 (59.4)		1.75	2.08
14 years	529 (54.3)	333 (62.9)		2.12	2.31
15 years	198 (20.3)	120 (61.9)		2.22	2.61
Father's/male guardian's highest level of education					
8th standard or below	258 (26.5)	173 (67.1)	19.383 (0.002)**	2.31	2.35
10th standard	228 (23.4)	150 (65.8)		2.14	2.28
12th standard	108 (11.1)	67 (62.0)		2.13	2.43
University	274 (28.1)	139 (50.7)		1.50	2.01
No father/guardian	32 (3.3)	22 (68.8)		3.16	3.15
Don't know	74 (7.6)	47 (63.5)		2.18	2.47
Mother's/female guardian's highest level of education					
8th standard or below	336 (34.5)	227 (67.6)	26.512 (0.00)***	2.40	2.43
10th standard	181 (18.6)	117 (64.6)		2.03	2.33
12th standard	129 (13.2)	71 (55.0)		1.74	2.07
University	210 (21.6)	102 (48.6)		1.39	1.95
No mother/guardian	15 (1.5)	12 (80.0)		3.13	2.61
Don't know	103 (10.6)	69 (67.0)		2.44	2.56
Community					
Forward Caste	60 (6.2)	31 (51.7)	19.887 (0.00)***	1.70	2.21
Backward Caste	443 (45.5)	249 (56.2)		1.65	2.06
Most Backward	198 (20.3)	122 (61.6)		2.19	2.52
Scheduled Caste and Scheduled Tribes	273 (28.0)	196 (71.8)		2.64	2.46
Location of school					
Rural school	516 (53.0)	332 (64.3)	4.015 (0.026)*	1.70	2.39
Urban school	458 (47.0)	266 (58.0)		1.65	2.24
Type of school					
Private school	509 (52.3)	278 (54.6)	20.675 (0.000)***	2.19	2.13
Public school	465 (47.7)	320 (68.8)		2.64	2.47

SD, standard deviation.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

Table 2 Multiple variable binary logistic regression analysis for prevalence of dental caries

Variable	B	SE	Wald	Sig.	e^B	95% CI for EXP (B)	
						Lower	Upper
Type of school†	0.35	0.17	4.06	0.044*	1.42	1.01	2.00
Caste			10.24	0.017*			
BC	Reference category						
FC	0.12	0.29	0.18	0.67	0.944	0.64	2.02
MBC	0.08	0.18	0.21	0.65	1.08	0.76	1.56
SC/ST	0.54	0.17	9.8	0.002**	1.71	1.22	2.40
Constant	−0.71	1.36	0.28	0.59	0.48		

Controls are father's and mother's education, location of school, age and gender (omitted from the table because of a non-significant Beta value). e^B = exponentiated *B*. For caste variable, backward caste is the reference category. †The type of school was coded as 1 for public school and as 0 for private school. 95% CI, 95% confidence interval; B, intercept; BC, Backward Caste; EXP (B), exponentiation of the B coefficient; FC, Forward Caste; MBC, Most Backward Caste; SC/ST, Scheduled Caste/Scheduled Tribe; SE, standard error; Wald, Wald chi-square; Sig, significance.
*$P < 0.05$.
**$P < 0.01$.

out of 1980 teeth were filled. In the total sample, 91% of participants reported that they had never been to a dentist.

The independent *t*-test (*Table 3*) was used to measure the association of DMFT scores with gender (male or female), type of school (private or public)

Table 3 Bivariate analysis between decayed, missing and filled teeth (DMFT) scores and different sociodemographic variables: (a) *t*-test; and (b) analysis of variance (ANOVA)

Category	DMFT score		Levene's test for equality of variance		*t*-test for equality of means			
	Mean	Standard deviation	*F*	*P*	Equal variance assumed		Equal variance not assumed	
					t	*P*	*t*	*P*
(a) *t*-test								
Gender								
Male	1.76	2.12	26.65	.000*		–	−4.189	0.000*
Female	2.39	2.50						
Geographical location of school								
Rural school	1.70	2.39	2.71	0.10	2.52	0.01*		–
Urban school	1.65	2.24						
Type of school								
Private school	2.19	2.13	15.71	0.000*		–	−4.875	0.000*
Public school	2.64	2.47						

	Sum of squares	d.f.	Mean square	*F*	Sig.
(b) ANOVA					
Age					
Between groups	40.06	4	10.05	1.863	0.115
Within groups	5,208.29	969	5.37		
Father's highest level of education					
Between groups	144.95	5	28.98	5.499	0.000*
Within groups	5,103.41	968	5.27		
Mother's highest level of education					
Between groups	177.32	5	35.46	6.770	0.000*
Within groups	5,071.03	968	5.23		
Community					
Between groups	178.36	3	59.45	11.375	0.000*
Within groups	5,069.98	970	5.22		
Total	5,248.35	973			

ANOVA, analysis of variance; d.f., degrees of freedom; Sig, significance.
*$P < 0.005$.

and location of school (urban or rural). The association for categories with more than two variables (namely age, father's education, mother's education and caste) was measured using ANOVA. The categories female subjects, 15-year-old subjects, participants who reported not having a father or a mother, Scheduled Caste or Scheduled Tribe, and participants studying in rural schools and public schools, had more severe dental caries compared with other categories within each variable. The bivariate analyses indicated that the differences in the DMFT scores between the different categories of sociodemographic variables were statistically significant (*Table 3*).

Multiple linear regression analysis (*Table 4*) was performed with preliminary analyses carried out using linear regression with each variable in turn. These all showed a significant relationship for all predictor variables. Hence, all predictor variables were included in the model at the same time rather than using a stepwise regression method. A second, reduced, model analysis (*Table 4*) was performed by forcing only those predictor variables which resulted in a significant beta coefficient in the first model. The predictor variables used in the final reduced model were mother's education, caste and gender.

The resulting R-square value was 0.066, which was expected to be lower for the developed model because of reduced variability for the dependent variable (DMFT score). Even though the DMFT score could fall between 0 and 32, the range of DMFT score in the current study was 0–9, which reduced the variability of the dependent variable. Field and Miles[11] indicated that in a regression model with little variability and a low R-square value there would still be a meaningful result, if the *F* value was significant. The *F* ratio for the developed model was highly significant ($F = 8.036$; $P < 0.001$), and the highly significant *P* value indicates a real relationship between the predictors and the dependent variable. This result indicates that the DMFT scores decrease with an increase in mother's highest level of education; however, by comparison, belonging to the Scheduled Caste/Tribes and Most

Table 4 Multiple variable linear regression analysis for decayed, missing and filled teeth (DMFT) scores

Variable	Unstandardised coefficients		Standardised coefficients	*t*	Sig.
	B	SE	Beta		
(Constant)	2.341	0.178		13.154	0.000
Gender (F = 0; M = 1)	−0.553	0.147	−0.118	−3.777	0.000**
Mother's education					
8th standard			Reference category		
10th standard	−0.275	0.209	−0.046	−1.313	0.189
12th standard	−0.556	0.235	−0.081	−2.367	0.018*
College	−0.880	0.210	−0.156	−4.196	0.000**
No mother	0.436	0.599	0.023	0.728	0.467
Don't know	−0.054	0.255	−0.007	−0.213	0.831
Community					
Forward Caste	0.335	0.323	0.035	1.036	0.300
Backward Caste			Reference category		
Most Backward Caste	0.386	0.196	0.067	1.969	0.049*
Scheduled Caste and Scheduled Tribes	0.792	0.177	0.153	4.468	0.000**

Dependent variable: DMFT.
Predictors: (constant) mother's education, gender and caste. B, beta coefficient; DMFT, decayed, missing and filled tooth; SE, standard error; Sig, significance.
*$P < 0.05$.
**$P < 0.001$.

Backward Caste increases the severity of dental caries. Gender was identified as a predictor of dental caries severity, with a significant and negative beta coefficient value for male participants, which denotes that being male decreases the chance of developing more severe dental caries compared with being female.

DISCUSSION

The results indicate that the prevalence of dental caries was 61.4% and the mean DMFT index was 2.03. Compared with developed countries, the prevalence and severity of dental caries is higher[12–15], which is probably because of the lack of oral health services and water fluoridation in the state of Tamil Nadu, India. The DMFT index reported in the current study was compared with the DMFT average obtained for the six WHO regions reported in the study by da Silveira Moreira's.[15] The mean DMFT score reported in the current study was higher than in four regions (West Pacific, East Mediterranean, Europe and South-East Asia) and lower than reported for American and European countries. Compared with other South-East Asian countries, the severity of dental caries is higher in the current study.[16] Economically, India is growing in a similar way as developed countries did in 1970, and increasing prevalence of dental caries is a negative outcome of this economic growth. In recognition of this, the Indian government is seeking to promote oral health services to address the issue.

When the results of the current study were compared with those of the multicentric study for 15-year-old subjects,[2] the results of the current study were higher than those for six sites, namely Arunachal Pradesh, Delhi, Maharashtra, Rajasthan, Orissa and Utter Pradesh, and lower than that reported for Puducherry. This could be a result of the highly westernised diet in this area. A comparative analysis of the DMFT average reported in other recent studies conducted in different parts of India,[2,17] including Tamil Nadu, is presented in *Figure 1*, together with the findings of the current study. *Figure 1* indicates that the DMFT score reported for each state has increased after the 2007 multicentric study, indicating that oral health status is deteriorating overall. The DMFT score reported in the current study (2.04) is second only to that reported in Maharashtra in 2012 (of 2.66). An increase in the mean DMFT score is observed throughout India and this is probably because of the urbanisation of the country and a lack of awareness about how to prevent oral diseases whilst adopting an increasingly westernised diet.

Compared with other states in India, the prevalence of dental caries is higher in Tamil Nadu. The current study sample has the lowest reported prevalence rate among those reported by other authors for the Tamil Nadu region, but in those studies, participants were drawn from a younger age. Participants who only had permanent teeth were recruited for the current study, and newly erupted permanent teeth are less affected by decay than are deciduous teeth, which have been exposed to the oral environment for a longer time. A recent study conducted by Moses *et al.*[18] reported a prevalence rate (63.83%) close to that of the current study and of note is that it is the only recent study that included 15-year-old subjects from the Tamil Nadu region.

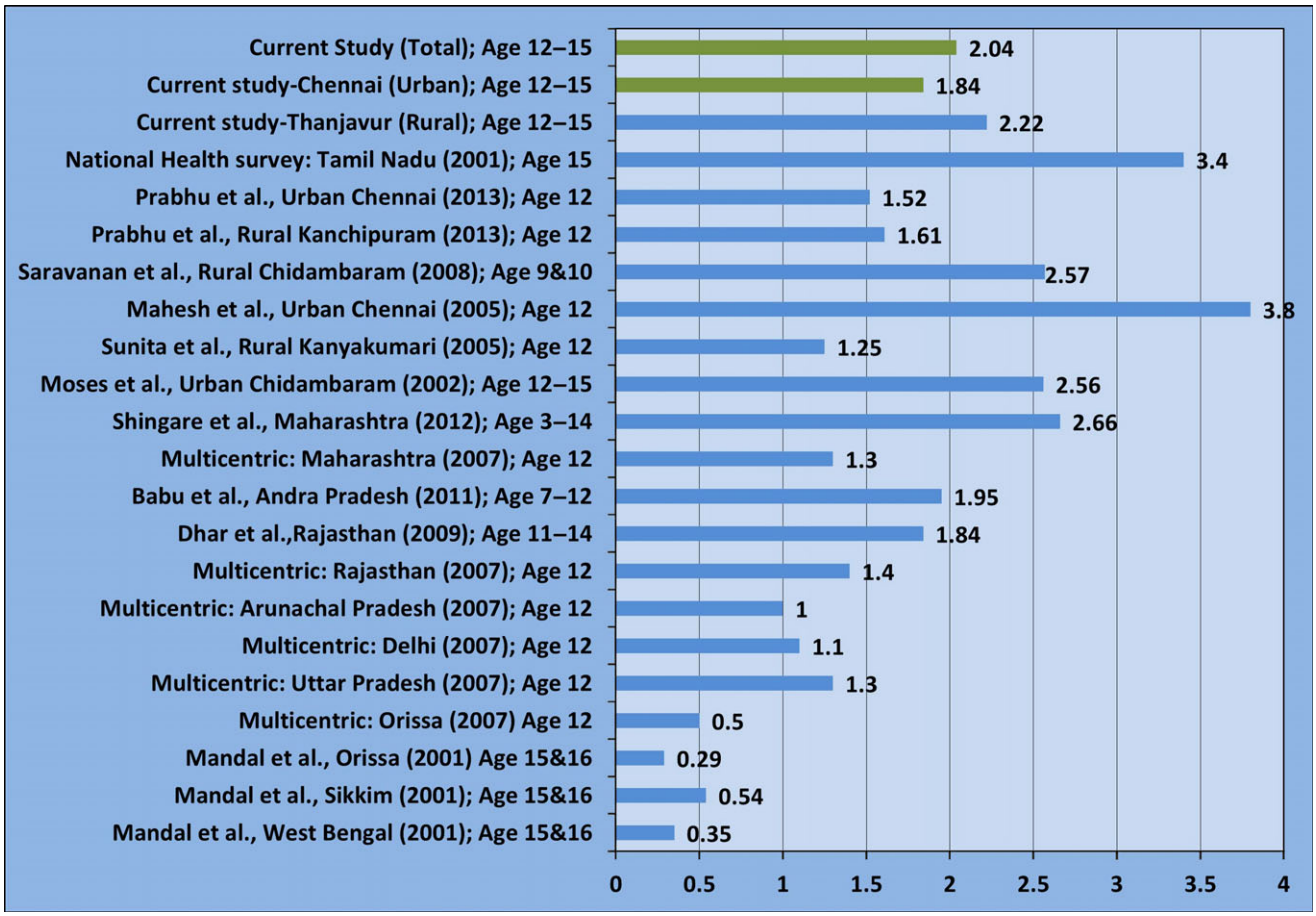

Figure 1. Average decayed, missing and filled teeth (DMFT) score in the current study and in other recent studies in India.

The effect of gender, parental literacy, community, location and the type of the school on the prevalence and severity of dental caries are discussed below.

Both the prevalence of dental caries and the DMFT score were higher for female participants compared with their male counterparts, and the results were statistically significant. These results were comparable with the findings reported in studies conducted in both rural and urban areas of India.[5,6] Female participants in rural areas were more affected when compared with their urban counterparts. This might be because of less access to nutritious food for female participants in rural areas compared with male participants and with female participants in urban areas because sons are considered more important for the family compared with daughters. This cultural belief is more common among families in rural areas than among families in urban areas. A nutritional study conducted among adolescent girls in rural areas indicated that thinness and stunted growth are more common in girls, as were related nutritional disorders anaemia, dental caries and angular stomatitis.[19] In the current study, the data available were not sufficient for further interpretation and explanation of gender disparity related to cultural beliefs and behaviours. More in-depth nutritional and parental attitude-based data will be needed to examine this phenomenon.

A strong negative correlation was identified between the parental level of education and dental caries prevalence rate and DMFT scores. This result also indicated that the mother's education level is far more important than the father's educational level for an adolescent's oral health. This might indicate that a mother is more likely to educate a child about oral health hygiene practices than is a father, and this effect is mediated by the mother's educational attainment and associated health literacy. This result is important because the dropout ratio for female students increases after upper primary school, and the Gross Enrolment Ratio in higher secondary school and at university level is very low for women compared with men. A common cultural belief is that formal education is not as important for women because of the expectation that they should become mothers.

The prevalence and severity of dental caries was higher in rural participants (64.3%; DMFT score = 2.22) than in urban participants (58.09%; DMFT score = 1.84), with these differences being statistically

significant. The prevalence and severity of dental caries was expected to be different in rural and urban areas because of differences in social class, population density and availability of oral health services in these areas. Comparing these differences provides important information to influence health policy, planning and decision making. This result is consistent with the results of the multicentric Indian study.[6] Research relating to India and the wider international context[20] has consistently reported a higher prevalence of dental caries and dental caries severity in rural populations.[14,21] A higher literacy rate among parents in Chennai, compared with patients in rural areas, combined with greater access to oral health services, were the most likely explanations for the lower reported prevalence and severity of dental caries in the urban areas.

A statistically significant difference was reported in the prevalence and severity of dental caries between subjects attending private schools (54.61%; DMFT score = 2.19) and public schools (68.81%; DMFT score = 2.64). One of the major reasons behind this difference is the underlying difference in socioeconomic status of students attending these schools. Another possible reason is that 60% of the sample participants were from the Scheduled Caste and Tribes community studying in public schools, and this caste category was also shown to be an important predictor of the prevalence of dental caries.

The community had a strong impact on dental caries in the adolescent population. The Indian Government divides various caste categories into Forward Caste, other Backward Castes, Most Backward Castes, Scheduled Castes and Scheduled Tribes. The scheduled caste (Scheduled Castes/Scheduled Tribes) populations were the official definitions given to various caste categories that are historically disadvantaged in the Indian community. In the current study, Scheduled Caste and Scheduled Tribes were grouped together as there were very few participants in the Scheduled Tribes category. The prevalence of dental caries in Forward Caste adolescents was the lowest of all categories (51.7%) and the prevalence was highest for the Scheduled Caste and Tribes community (71.8%), which is considerably higher than for other castes. The Most Backward Caste and Scheduled Caste were 1.08 and 1.79 times, respectively, more likely to develop dental caries. This result implies that the Scheduled Caste and Tribes community are vulnerable populations. Out of 273 Scheduled Caste and Scheduled Tribes participants in the study sample, about 71.8% had dental caries (i.e. one-third of the total sample population affected). This result was confirmed in the logistic multiple regression analysis, and the Scheduled Caste/Scheduled Tribes category was shown to be a significant predictor of both prevalence and severity of dental caries when controlling for other sociodemographic variables. Lack of education and poor economic status have for many years placed these populations' oral health under scrutiny. There are various policies in India to enhance the health, education, and social and economic status of the Scheduled Caste or Scheduled Tribes population, but there are no policies that focus, in particular, on the Scheduled Caste and Scheduled Tribes population in regard to oral health.

Although the study was carefully designed and accomplished its aims, there were some unavoidable limitations. The urban participants were recruited from four schools rather than from the proposed sample of eight schools because of issues in gaining permission from some of the schools. Recruiting participants from the sample of eight schools, as proposed, would have covered the majority of suburbs in Chennai and would have provided a truly representative sample of the total adolescent population in Chennai. Future research should obtain permission from the Tamil Nadu Education Department with a list of schools randomly selected, who could then be advised of the study. This process would increase the chances of securing support from the schools, particularly those in urban areas.

The majority of participants who reported that they did not know their parents' level of education also had a higher prevalence and severity of dental caries. It was assumed that these parents are illiterate and that the participants did not want to report this sensitive information. Accordingly, future studies should be designed with a view to collect parental educational status more accurately to avoid this assumption, because there is a high correlation between parents' educational attainment and adolescents' oral health literacy/oral health status.

CONCLUSION

This research identified two groups in Tamil Nadu as vulnerable populations that are likely to be most affected by dental caries: those who attend public schools in rural areas and who are female (child and adolescent); and/or children/adolescents who are a member of a Scheduled Caste or Scheduled Tribes community. The oral health policies targeting the Scheduled Caste and Scheduled Tribes population, which includes 25% of the total Indian population, would make a huge positive impact in the community because 33% of the affected population in the current study were from these communities.

Future studies are required to gain a better understanding of the existence of the reported gender disparity and its effect on nutritional-based oral health issues among women in rural parts of Tamil Nadu.

The relationship between caste and dental caries has rarely been studied, and future epidemiological studies on dental caries, conducted in India, should consider caste as an important predictor. This would help policy makers to identify at-risk groups and provide better access to oral health services for lower caste populations throughout India. Decreasing the school dropout ratio for female subjects, improving the overall literacy rate and increasing university enrolment could also promote improved oral health outcomes in Tamil Nadu. Economists and sociologists in India have not made a connection between women's education and child health. The strong relationship between a mother's education and her child's health should be better understood by policy makers, and the current policies on decreasing female dropout ratio could be strengthened.

The study results imply that future oral health policies in Tamil Nadu should concentrate more on the adolescent female population living in rural areas and attending public schools and on the Scheduled Caste/Tribes population living in both rural and urban areas of Tamil Nadu to improve oral health outcomes in these communities.

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Conflict of interest

The authors declare no conflicts of interest.

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