

Article

Dental caries and the associated factors influencing it in tribal, suburban and urban school children of Tamil Nadu, India: a cross sectional study

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Significance for public health

It was observed from the present study that the socioeconomic status, parents' educational status, media and family structure influence the oral health of children in under-privileged communities. Oral hygiene practices, dietary habits and access to dental care services also play an important role in the prevalence of dental caries among children. Children of government schools in Tamil Nadu, India, don't get adequate information on oral health, related diseases and methods of prevention. Oral health education and health promotion should be mandatory for all school children.

Abstract

Background. The study was planned to assess the prevalence of dental caries among tribal, suburban and urban children of Tiruchengode and Erode of Tamil Nadu state, India. The objective of the study was to assess the association of dental caries with family background, dental service availability, transportation and knowledge on preventive dental measures among these three groups

Design and methods. Cross-sectional study. A total of 1028 school children in the age range of 9-12 years from various government schools located in Palamalai and Kolli Hills (tribal), Tiruchengode (suburban) and Erode (urban), Tamil Nadu, were included in the study. Decayed, filled, and missing teeth (DMFT), decayed and filled teeth (dft) and Significant Caries Index were recorded. A specially prepared questionnaire was used to record all the data regarding oral hygiene practices, socioeconomic background, dental treatment availability, parent's education level were used for the study. ANOVA t-test and *post hoc* test were used for comparing quantitative variables between the 3 subgroups.

Results. The tribal school children had 89.3% caries prevalence, where as it was 77% in suburban and 55% in urban school children. The mean DMFT score among tribal, suburban and urban school children were statistically significant different ($P=0.001$) between the three groups. There was a highly significant difference ($P=0.001$) in the mean DMFT score based on brushing frequency. There was a statistically significant difference ($P=0.018$) in the mean DMFT scores in the urban group based on the mothers education status. There were no statistically significant differences in the mean DMFT scores based on the presence or absence of television in their house and the parents' income.

Conclusions. Oral hygiene practices, dietary habits and access to dental care services played an important role in prevalence of dental caries. It was observed that the socioeconomic status, parents' educational status and mass media influenced the oral health of these children but without a significant contribution.

Introduction

Dental caries, the most common oral disease shows a striking difference in its distribution all over the world. The global distribution of dental caries presents a varied picture. In several industrialized countries a reduction of dental caries incidence and improvement of gingival health care are evident because of the preventive measures undertaken.¹ In developing countries, migration of people from rural areas and urbanization causes a change in the lifestyle and dietary habits which in turn affects the oral health. The scenario in India also shows a similar increase in prevalence with other developing countries. Many surveys regarding oral health have revealed increasing trends in dental caries prevalence among the children.² Socioeconomic status, low education status of parents and parental attitude has an impact on establishment of oral health habits in children.

The health status of any community is influenced by the interplay of health consciousness of the people, socio-cultural, demographic, economic, educational and political factors. The common beliefs, traditional customs, myths, practices related to health and disease in turn influence the health seeking behaviour of autochthonous (tribal) people.³ Tribal communities are mostly forest dwellers. The tribal people are *primitive* based on pre-agricultural level of technology, low level of literacy, stagnant or diminishing population size, relative seclusion (isolation) from the main stream of population, economical and educational backwardness, extreme poverty, dwelling in remote inaccessible hilly terrains, without logistic support, maintenance of constant touch with the natural environment and unaffected by the developmental process.³ Their health system and medical knowledge over ages known as *Traditional Health Care System* depend both on the herbal and the psychosomatic lines of treatment. While plants, flowers, seeds, animals and other naturally available substances formed the major basis of treatment, this practice always had a touch of mysticism, supernatural and magical, often resulting in specific magic-religious rites.³ *Faith healing* has always been a part of the traditional treatment in their health care system, which can be equated with rapport or confidence building in the modern treatment protocol.

There is a paucity of comprehensive health research among the tribal populations of India. Most of the studies are isolated and fragmentary in nature. In India, children comprise 40% of the rapidly growing population.⁴ But the provision of health care, especially dental health services is poor in rural and tribal schools. Literature search showed hardly any studies on the prevalence of dental caries in tribal school children of Tamil Nadu State, India. Hence, this cross sectional study was planned to provide the base line data of prevalence of dental caries among school going children of tribal, suburban and urban parts of Tiruchengode and Erode, Tamil Nadu State, India. The objective of the study was to assess the association of dental caries with family background, dental service availability, transportation and knowledge on preventive dental measures among these three groups

Design and Methods

The present study was conducted from the Department of Pedodontics and Preventive dentistry, KSR Institute of Dental Science and Research, Tiruchengode. Study protocol was approved by the institutional review board and ethical committee approval was obtained. A pilot study was carried out among the tribal, suburban and urban population to determine the sample size for each group (at 95% confidence level; 5% precision) needed for the proposed study. A minimum sample of 138 tribal, 185 suburban and 369 urban children was needed for the study. A total of 1028 school children in the age range of 9-12 years from 12 government schools located in Palamalai and Kolli Hills (tribal), Tiruchengode (suburban) and Erode (urban), Tamil Nadu were included in the study. Written consent from the principals of the concerned schools was obtained. To avoid inter-examiner variability all the children were examined by a single examiner who was trained to record World Health Organization (WHO) oral health assessment form.⁵ The children were examined by using mouth mirror and explorer under natural light. The WHO oral health assessment form (1997) was used for recording dentition status. Decayed, filled, and missing teeth (DMFT), decayed and filled teeth (dft) and Significant Caries (SiC) indices were recorded. Since the study population involved children in mixed dentition period, both dft and DMFT indices were recorded. This was done to know the caries status of both the primary and permanent teeth of these children. SiC index score is calculated by sorting the individuals according to their DMFT and selecting one third of the population with the highest caries values. This index can be used as a complement to the mean DMFT value. A specially prepared questionnaire (18 questions) based on the study by Valdenice Menzes *et al.*⁶ was used to record all the data regarding oral hygiene practices, socioeconomic background, dental treatment availability, parent's education level were used for the study. The primary investigator explained each question to the students in the presence of the class teacher and the students were instructed to choose the appropriate answers.

The data obtained were statistically analysed using SPSS version 15 software. ANOVA, t-test and *post hoc* test were used for comparing quantitative variables between the 3 subgroups.

Results

Among the 1028 school children, there were 206 tribal children and 411 suburban and 411 urban children who participated in this study. The tribal children were included from four schools: two from Palamalai hills and two from Kolli hills. The suburban and urban children belonged to four schools each from Tiruchengode and Erode respectively. There was a difference in the sample size between the three groups as the minimum sample size was different in each group. The tribal school children added to a total of 206 in the 4 schools present in the tribal areas. All children from 4 schools each in suburban and urban category were included in the study. This distribution was based on the estimation made from the results of the pilot study. Table 1 shows the distribution of school children among three groups based on age. In the tribal school children, 46.1% (95) were boys and 53.9% (111) were girls. In the sub urban school children 63.30% (259) were boys and 36.70% (152) were girls. In urban school children 47% (193) were boys and 53% (218) were girls. Table 2 shows the mean DMFT and dft score of the school children among the three groups. The tribal school children had the highest mean DMFT followed by the suburban and then the urban school children. Both the DMFT and dft scores showed a statistically significant difference among the three groups. In the present study the significant caries index scores for the tribal, sub-

urban and urban school children tapered similar to their mean DMFT scores. This indicated that the DMFT score was representative of each of the subgroup population.

Among the total tribal school children (N=206), 38% (N=80) from Palamalai hills did not have road and transport facility while 62% (N=126) from Kolli hills had road and transport facility. The mean DMFT was 2.34 ± 1.706 for Palamalai children, whereas it was more in Kolli hills children (3.22 ± 1.967) as depicted in Table 3.

Finger was used as the cleaning aid by 27.2% of tribal population, 3.9% of suburban and 1% of urban school children. 91.5% urban, 81% suburban and 73.8% tribal school children used toothpaste with tooth brush. Tooth powder with tooth brush was used by 22.40%, 16% and 4.50% of tribal, suburban and urban school children respectively. The mean DMFT in the total school children who used toothpaste were 2.07 ± 1.763 and it was 2.196 ± 1.786 in the tooth powder group. The results were not statistically significant ($P=0.742$). The mean dft was 1.27 ± 0.74 with toothpaste, while it was 1.26 ± 1.5 when tooth powder was used. The results were not statistically significant ($P=0.357$).

Among tribal school children 85% brushed their teeth once and 13% brushed twice daily, whereas 48% of the suburban school children and 43% of the urban children brushed their teeth twice daily. The mean DMFT score was 1.95 ± 1.716 in total school children who brushed once and it reduced to 1.48 ± 1.805 in children who brushed their teeth twice a day. There was a highly significant difference ($P=0.001$) in the mean DMFT score based on brushing frequency. Similarly, the mean dft score was 1.8 ± 0.98 in school children who brushed once daily and it reduced to 1.59 ± 0.86 in children who brushed twice daily. There was a highly significant difference ($P=0.02$) in the mean dft score also based on brushing frequency. About 62% of tribal school children, 68.9% subur-

Table 1. Distribution of the school children among the three groups based on age.

Age group (years)	Tribal, N (%)	Suburban, N (%)	Urban, N (%)
9 to 10	56 (27.18)	25 (6.08)	254 (61.8)
10 to 11	51 (24.75)	42 (10.21)	102 (24.8)
11 to 12	99 (48.05)	344 (83.4)	55 (13.3)
Total	N=206	N=411	N=411

Table 2. Mean decayed, filled, and missing teeth (DMFT) and decayed and filled teeth (dft) scores of school children among the three groups. Results are expressed as mean \pm standard deviation.

	Tribal (206)	Suburban (411)	Urban (411)	P value*
DMFT	2.88 ± 1.910	2.42 ± 1.714	1.22 ± 1.390	≤ 0.001
dft	1.83 ± 2.097	0.86 ± 1.495	1.81 ± 1.938	≤ 0.001

*ANOVA test.

Table 3. Comparison of mean decayed, filled, and missing teeth (DMFT) and decayed and filled teeth (dft) scores among the tribal school children with and without road facility. Results are expressed as mean \pm standard deviation.

Tribal school children (N=206)	DMFT score	dft score
Without road and transport facility (N=80), Palamalai	2.34 ± 1.706	1.90 ± 2.010
With road and transport facility (N=126), Kolli Hills	3.22 ± 1.967	1.79 ± 2.160
P-value*	0.001	0.720

*t-test.

ban and 60.6% of urban school children never visited a dentist. The overall mean DMFT of the school children who visited the dentist was 2.03 ± 1.798 , while the children with no previous dental visit had DMFT of 2.04 ± 1.650 . There was no statistically significant difference ($P=0.332$) in mean DMFT score based on their dental experience. The overall mean dft score of the children who had a previous dental visit was 1.24 ± 1.20 and the dft score for children with no previous dental visit was 1.48 ± 0.69 without dental visit. There was a statistically significant difference ($P=0.02$) in the overall mean dft scores based on their dental experience. About 43.2%, 25.3% and 22.4% of tribal, suburban and urban school children visited a dentist due to tooth pain; 3.9% tribal school children, 19.7% of urban and 13.6% suburban school children consulted the dentist as a part of routine dental check-up; 22%, 18% and 19.2% of tribal, suburban and urban school children did not visit a dentist due to dental fear/anxiety; 68.9 % of suburban school children did not visit a dentist as they did not have any pain in their teeth. 20%, 16.1% and 2.9% of tribal, suburban and urban school children did not have any reasons for not visiting a dentist.

Fathers of 39.3% tribal school children, 16.3% suburban and 14.4% urban children were illiterates. Fathers of 2.7% suburban, 11.2% urban and 2.9% tribal children were graduates. Mothers of 56.8% tribal school children, 26.3% suburban school children and 20.2% urban school children were illiterates. Basic school education was completed by 24.75%, 23.8% and 39.2% of tribal, suburban and urban mothers respectively. The mean DMFT scores of children born to illiterate mothers in tribal, suburban and urban group were 3.02 ± 1.903 , 2.26 ± 1.769 and

0.98 ± 1.179 respectively (Table 4). There was a statistically significant difference ($P=0.018$) in the mean DMFT scores of the children of urban mothers based on their mothers education status. Post hoc analysis showed that there were significant differences in 2 comparisons: Illiterate mothers and higher secondary educated mothers ($P=0.046$) and graduate mothers and higher secondary educated mothers ($P=0.048$).

The mean DMFT score of school children who owned television ($N=800$) was 2.02 ± 1.74 , while the mean score was 2.06 ± 1.87 in the children who did not own a television ($N=228$) in their house as shown in Table 5. Irrespective of the place, considering only the presence or absence of television there was no difference in the overall mean DMFT of these children. There was no statistically significant difference in the mean DMFT scores within each group based on the presence or absence of television in their house.

About 80% of the parents in the urban population had a monthly income more than five thousand rupees as shown in Table 6. But only 36% and 6% of parents of the suburban and tribal school children made a monthly living of Rs 5000 and above. However, parents of 94% of tribal school children and 64% of suburban children made a monthly income of less than Rs 5000. The mean DMFT score of the children whose parent's monthly income was below Rs 5000 was 2.02 ± 1.76 , whereas the DMFT score for monthly income above Rs 5000 was 1.97 ± 1.74 . This was no statistically significant difference in the mean DMFT scores based on the parents' income.

Table 4. Comparison of mean decayed, filled, and missing teeth scores among the school children based on their mothers' educational status.

Mothers education	Tribal		Suburban		Urban	
	N (206)	DMFT (Mean±SD)	N (411)	DMFT (Mean±SD)	N (411)	DMFT (Mean ± SD)
Basic school	51	2.53±1.983	98	2.38±1.665	161	1.14±1.381
Below 10th	22	2.73±1.420	97	2.47±1.588	92	1.35±1.456
Higher secondary	9	2.67±2.121	94	2.60±1.839	63	1.65±1.547
Graduate/post graduate	7	3.86±2.478	14	2.29±1.684	12	0.67±0.888
Illiterate	117	3.02±1.903	108	2.26±1.769	83	0.98±1.179
P value*		0.356		0.803		0.018

*ANOVA test.

Table 5. Comparison of mean decayed, filled, and missing teeth scores among the school children based on the presence of television in their home.

	Tribal (206)		Suburban (411)		Urban (411)		Total population (1028)	
	N	DMFT (Mean±SD)	N	DMFT (Mean±SD)	N	DMFT (Mean±SD)	N	DMFT (Mean±SD)
Own TV	120	2.97±1.98	349	2.41±1.68	331	1.27±1.37	800	2.02±1.744
Don't own TV	86	2.76±1.80	62	2.47±1.87	80	1±1.42	228	2.06±1.872
P value*		0.42		0.81		0.13		0.756

*t-test

Table 6. Comparison of mean decayed, filled, and missing teeth scores among school children based on their parents' monthly income.

	Tribal (198)**		Suburban (405)**		Urban (409)**		Total population (1012)**	
	N	DMFT (Mean±SD)	N	DMFT (Mean±SD)	N	DMFT (Mean±SD)	N	DMFT (Mean±SD)
<5000 Rs	186	2.82±1.857	260	2.40±1.74	82	1.01±1.31	773	2.02±1.767
>5000 Rs	12	3.08±2.275	145	2.42±1.68	327	1.27±1.41	239	1.97±1.745
P value*		0.698		0.924		0.120		0.702

*t-test. **Data about the parent's income of 16 children could not be obtained (8 in tribal, 6 in suburban and 2 in urban) and hence the total in each group will not match with the actual sample distribution.

Discussion

Oral health has progressed remarkably in most developed countries due to various rapid advances in the field of preventive dentistry. In developing countries and especially in the underprivileged groups oral diseases are on an increase. This can be due to limited access to dental care, technology and vocational qualification. This study attempted to find the prevalence of caries and the possible association between various factors that can affect the caries status of tribal, suburban and urban children. The categorisation of suburban and urban was based on the discrimination done by the State Government. It was based on the factors like urbanisation, facilities and amenities of the place.

Dental caries prevalence

The dental caries prevalence in this current study ranged from 55% to 89.3%. The tribal school children had 89.3% caries prevalence, whereas it was 77% in suburban and 55% in urban school children. The mean DMFT among tribal, suburban and urban school children were statistically significant different between the three groups. A similar finding was observed by Abhinav Singh (2011)⁷ in tribal school children in Udipi, Karnataka State, India. Higher mean DMFT scores were also reported in studies conducted in 8 European countries and West Indies. Indigenous population of Guatemala, Central America with mean DMFT of 10.2 also showed higher levels of caries.⁸ Contradictory to these findings, Rao *et al.*⁹ found dental decay less prevalent among tribal school children in Wardha, Maharashtra State, India. The tribal children in Mandu district, Madhya Pradesh, India exhibited a low prevalence of dental caries, both in primary and permanent dentitions, compared to rural and urban Indian children of same age groups.¹⁰ The low caries level could have been due to simple, coarse and traditional fibrous food consumed by the tribal children.¹⁰ The high decay component in dft among the urban school children may be due to shift in diet pattern towards more refined food, access and availability of junk food/snacks, pampered children and lack of appropriate knowledge about oral hygiene. Grewal *et al.*¹¹ and Chaturvedi *et al.*¹² reported that urban school children showed an increase in decay component in dft index. Higher caries prevalence and mean dft score in tribal school children in this study may be due to improper brushing techniques, lack of knowledge on the importance of milk teeth, oral health awareness, socioeconomic status, lack of road transportation and availability of dental facilities.

The suburban school children can be considered as *watch out group* since they can go in either way, as they may be exposed to growing urbanized diet pattern which plays a vital role in caries progression. Commercial advertisements of sweets, chocolates or snacks in media may also be a factor for increased preference for urbanized food. Sofowora *et al.*¹³ concluded that the poor dental visits, poor oral hygiene and high proportion of unrestored carious teeth increased dental caries in Nigerian suburban school children.

Road and transport facility

Children with access to road and transport had more caries than those without access. Easy access by road, westernization of diet, lack of scientific knowledge, cultural difference and absence of water fluoridation program may be the reasons for increased caries level in Kolli hills. In Palamalai hills, since the logistic support was low, diet remained unchanged. The diet of Palamalai children consisted of simple, coarse and traditional fibrous food.

The dft score was more in Palamalai 1.90 ± 2.010 when compared to Kolli hills 1.79 ± 2.160 . Delay in the exfoliation of the carious primary teeth could have possibly increased the dft score in these children. Early childhood malnutrition has been associated with caries in pri-

mary dentition and malnutrition has also been associated with delayed exfoliation of the primary teeth.¹⁴

Brushing frequency

About 48% of the suburban and 43% urban school children had twice brushing habit, while majority (85%) of tribal school children brushed once daily. The mean DMFT score of school children brushing once was more in all the three groups. On comparing the DMFT scores based on brushing frequency, the mean DMFT decreased as brushing frequency increased. Contrary to this finding David *et al.*¹⁵ found no association between brushing frequency and caries prevalence and severity.

Materials used with tooth brush

Majority of urban and suburban (91.5% and 81%) school children used tooth paste while only (73%) in tribal used toothpaste. Tooth powder was used more by tribal school children (22.40%) when compared to the suburban and urban groups (16% and 4.50% respectively). There were no statistically significant differences in the mean DMFT and dft scores based on the material used for tooth brushing. Rao *et al.*⁹ described various materials like Manjan, nus (tobacco powder), coal (homemade burnt coal in grinded form), Dantum (neem stick) used for cleaning teeth in the tribal school children. Bhat *et al.*¹⁶ showed that majority of tribal population (79%) chew stick as oral hygiene aid. However the above mentioned products were not used by the tribal children in the present study.

Dental visits

Pain is the main driving factor for children to visit dentist.^{6,17} Children are generally taken to the dentist by their parents only when symptoms of pain exist. Despite the change in oral needs awareness, children are still far from a preventive vision. The other important reasons for not visiting dentist are fear and high cost of dental treatment. Oral health care in India, especially in rural and tribal areas is limited due to shortage of dental manpower, financial constraints and the lack of perceived need for dental care. The present study shows that in the tribal school children 62% never visited the dentist; whereas 68.9% of the suburban and 60.6% of the urban children never visited the dentist. The reason for not visiting dentist may be due to factors like fear, lack of dental knowledge among parents, family income, lack of facilities and infrastructure, misconception regarding dental treatments due to illiteracy.^{2,18}

Socio economic status

Socio economic status is one of the contributing factors for developing dental caries. In Brazil,⁶ it was noticed that access to dental care varies among social groups. Children from lower socioeconomic status received irregular care and it was through the school dental services on a pain relief basis. On the other hand most of the children from higher socioeconomic groups received regular dental check-ups and treatment through the private systems.⁶ Research in industrialized countries revealed that children of high social class families experience less caries than those of lower social classes.¹⁹ The DMFT scores was high in low socioeconomic status because of their poor oral hygiene practice, lack of awareness, improper food intake and poor family status.^{19,20}

The present study used the monthly income of the parents of the school children as the parameter of their socioeconomic status. Monthly income was grouped into two categories: above and below five thousand rupees. The overall mean DMFT score was lesser in the lower income group. But there was no significant difference in the mean DMFT score between the two groups. Probably the children belonging to the higher income group had access to more frequent snacks and sweets. This finding was contradictory to results of the studies done by

Damle *et al.*,²¹ Sogi,¹⁹ Moses,²⁰ and Menzes.⁶ The children in this study were chosen from government schools. The findings and results could have been different if children from private schools and higher socioeconomic status were included.

Educational level of parents

Mother is an important figure in the family and is usually considered as the cornerstone of the family. Mother's age, domicile, education level, employment, level of anxiety, oral health knowledge, pattern of dental care utilization and her oral health status affects the child's teeth and attitude towards oral health.²² Mothers' positive oral health-related attitudes lead to better oral cleaning habits in children. Furthermore, it was detected that mother's dental attendance pattern may influence their children's dental health and attendance and such relation was confirmed by other reports on child oral health behaviour in other countries.²² Studies by Kiwanuka *et al.*²³ and Mascarenhas *et al.*²⁴ suggested the influence of maternal educational on the dental health of their children. Children of the mothers with higher educational qualification, reported to have better dental health. Sharma *et al.* observed a strong relationship between the DMFT score of children and their mother's education. Caries was found to be higher in children of mothers with low educational level.²⁵ In this study, there was no significant difference in the mean DMFT scores of the children based on the mothers' education status except in the urban population. Since the socioeconomic status of all the children was the same, mothers' educational status probably did not affect the caries status of these children. But the role of mothers' educational level on the oral health of the child is an important factor to be considered.

The numbers of illiterate fathers were lesser than the illiterate mothers in the tribal, suburban and urban group. Compared to the mothers, more fathers had completed higher secondary and graduate level education. Parental education improves awareness and understanding of health related issues and better the dental health practices of the child. Parents with a positive dental attitude and better dental knowledge will probably help their children develop better dental health habits. Thus, it is of great importance to involve the parents in dental health promotion programs.²²

Role of mass media

Mass media can directly and indirectly produce positive changes or prevent negative changes in health-related behaviours across large populations. Television can be considered as the best source of education. It has coverage to large number of people, can reach illiterate people, and influence public opinion effectively. Harikiran *et al.*²⁶ showed that school children received information regarding oral health mainly from television. Varenne *et al.* showed that children living in urban areas received oral health information from their parents.²⁷ The reason for this difference may be due to the higher level of education in the urban parents when compared to the parents of rural school children. The present study showed that 80% and 85% urban and suburban school children owned television in their houses while only 58% of tribal children owned a television. There was no statistically significant difference in the mean DMFT scores of the children based on the presence or absence of television at home.

Conclusions

The study focussed on only children in tribal, suburban and urban areas of Tiruchengode and Erode, Tamil Nadu State, India. Hence the results cannot be generalised to the overall population of the area studied. Within its limitations, this study provides valuable information on

the caries prevalence and the associated risk factors in the above mentioned population. Oral hygiene practices, dietary habits and access to dental care services played an important role in prevalence of dental caries. It was observed that the socioeconomic status, parents' educational status and mass media influenced the oral health of these children but without a significant contribution. Children of government schools do not get sufficient information on oral health, related diseases and methods of their prevention.

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