

# Prevalence of early childhood caries and its risk factors in 18–72 month old children in Salem, Tamil Nadu

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## Abstract

**Background:** Early childhood caries (ECC) is one of the most common dental diseases among the preschoolers, leading to suboptimal health. A study was planned to evaluate the prevalence of ECC in preschool children in the age group between 18 and 72 months and its relationship with parent's education and socioeconomic status of the family. **Materials and Methods:** This cross-sectional study was conducted among 2771 children selected randomly, in the age group 18–72 months and attending playschools and primary schools in urban, semi-urban, and rural areas of Salem, Tamil Nadu. A modified Winter *et al.* questionnaire and a proforma were used for collecting information on each child. The completed questionnaire and proformas were statistically analyzed and evaluated. The statistical analysis was done using Student's *t*-test and analysis of variance (ANOVA) to obtain mean values. **Results:** The prevalence of ECC in Salem was 16% with a mean dfs of  $5.23 \pm 1$ . Prevalence was high among the children of low socioeconomic status group and the children of working mothers, with a mean dfs of 10.47. **Conclusion:** The prevalence of ECC was 16% in Salem, Tamil Nadu. ECC was seen more in children of working mothers, lower parental education, and lower socioeconomic groups.

**Key words:** Early childhood caries, feeding practices, preschooler, prevalence, socioeconomic status

## INTRODUCTION

Oral health is an important component of general health in the normal development of a child and has a potential to contribute to the well-being of both the child and the family.<sup>[1]</sup> Despite the fact that the oral health of preschool children has improved considerably in most industrialized countries over the past decade, dental caries remains an important

childhood disease affecting a considerable proportion of young children.<sup>[2]</sup>

The broader term, early childhood caries (ECC), was proposed at a 1994 Centre for Disease Control and Prevention workshop, as this denotes any form of caries occurring in the primary dentition of infants and youngsters.

ECC poses a significant public health problem in preschool children. Even though it is not life-threatening, it may contribute to suboptimal health and failure to thrive. Children having caries in their infancy period tend to develop additional dental decay in their primary teeth, and are also more likely to develop dental caries in their permanent dentition, which leads to interference of their growth and development, and school participation.<sup>[3]</sup>

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The American Academy of Pediatric Dentistry (AAPD) defined ECC as the presence of one or more decayed (non-cavitated or cavitated), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger.<sup>[4]</sup> Various studies have been done to determine the prevalence of nursing caries worldwide. The global prevalence of ECC has been reported to range from 1 to 70%.<sup>[5]</sup> In England, the prevalence has been reported to range from 6.8 to 12% and in the USA, a prevalence of 11.0–53.1% has been reported.<sup>[6]</sup> Few studies have also been reported from India, which show a prevalence of 19.2% in Davangere.<sup>[7]</sup> Although the prevalence data of various regions are available, long waiting lists for treatment of ECC in hospitals indicate that many children still suffer from this condition.

Children in this study were mostly from low socioeconomic status (SES), with poor feeding conditions and dietary patterns, and having limited utilization of healthcare facilities. Previously no studies were carried out on ECC in the southern state of Tamil Nadu Salem to assess the prevalence and its associated factors.

Keeping this in mind, the study was planned to evaluate the prevalence of ECC among preschool children in Salem, Tamil Nadu, who were in the age group of 18–72 months, and also to evaluate the influence of various risk factors like SES and parental education.

### Aims and objectives

- To find the prevalence of ECC in Salem, Tamil Nadu
- To determine the relationship of risk factors like SES and parental education with ECC.

## MATERIALS AND METHODS

### Institutional ethical committee

This study was approved by the ethical committee of Vinayaka Mission's Sankarachariyar Dental College. Before beginning the study, the permission letter was obtained from the concerned educational authorities and from the heads of the schools to examine the school children. A questionnaire form was sent to the parents, along with a consent form for the child's participation and parent's participation through the school head.

### Study setting

The present study was conducted among 2771 children, who were selected randomly from 54 schools and were

in the age group of 18–72 months, attending playschools and primary schools of government, government-aided, and private management in urban, semi-urban, and rural areas of Salem. Among the 2771 children selected, 1771 were boys and 1000 were girls. The sample size was determined with a confidence interval of 95% and significance level of 5% ( $P \leq 0.05$ ).

### Duration of study

The study was carried out over a period of 10 months including the period for data collection, statistical analysis, and writing the dissertation report.

### Study design

A community-based cross-sectional study.

### Inclusion criteria

Preschool children of age 18–72 months.

Children present in the school on the day of examination.

### Exclusion criteria

Children below 18 months and above 72 months of age.

Mentally challenged children.

Children with developmental disorders of teeth.

### Data collection

This study was undertaken in two stages:

- Stage 1- Intraoral examination and
- Stage 2- Comprising of a questionnaire.

All the children were examined by an experienced dentist, who underwent a training session in the Department of Pedodontics and Preventive Dentistry prior to and during the study to ensure that a consistent standard of the diagnosis was maintained, with a random constant check on the inter-examiner variability ( $\kappa$  value = 90%).

Knee-to-knee examination method was also utilized in the case of very young children. Intraoral examination to assess dental caries was done according to the World Health Organization (WHO) criteria (1997).<sup>[8]</sup> Examination was carried out in the schools under visible light using a disposable mouth mirror, Community Periodontal Index (CPI) probe, and gauze for drying the teeth. The CPI probe was

used to confirm visual evidence of caries on the occlusal, buccal, lingual, palatal, mesial, and distal and incisal surfaces.

A tooth was recorded decayed (d) if there was visible evidence of cavitations, filled (f) if the tooth was restored, and extracted (e) if extracted due to caries. An assistant recorded the observations given by the examiner, which took approximately 10–12 min.

### Oral health questionnaire

For each child who participated in the study, the following were recorded:

- Number of teeth present
- Dfs index according to Gruebbel criteria.<sup>[9]</sup> The criteria used for assessing ECC in our study were: The presence of caries on the labial or lingual surface of at least two maxillary incisors, with absence of caries in mandibular incisors.<sup>[5,7]</sup>

Secondly, modified Winter *et al.*<sup>[10]</sup> questionnaire was given to the parents, which consisted information on child's name, age, gender, date of birth of child, mother/father/guardian name, age, gender, maternal work status, parent's education, and SES.

Finally all the participants, mothers, and teachers received instructions related to oral hygiene at the end of the clinical examination.

### Statistical analysis

All the data were entered in a data entry form and statistical analysis was performed using the program Statistical Package for Social Sciences (SPSS Inc., version 11.5, USA). For all statistical tests, a confidence interval of 95% and significance level of 5% ( $P \leq 0.05$ ) were adopted.

### Student's independent *t*-test

The independent sample "*t*" test procedure was used to compare the mean dfs scores of the two groups.

### Analysis of variance test

The test for mean dfs score analysis, analysis of variance (ANOVA) test procedure, was used to compare the mean dfs scores in more than two groups.

The results for each parameter were tabulated. Proportions were compared using Chi-square test of significance.

## RESULTS

This study was carried out to evaluate the prevalence of ECC in Salem and to compare its relationship with parental education and SES of the family.

### Distribution of subjects

Of the 2771 children studied, 1771 (63.9%) were boys and 1000 (36.1%) were girls [Table 1, Graph 1]. Distribution of children in rural area, semi-urban area, and urban area was 1022 (36.9%), 1300 (46.9%), and 449 (16.2%), respectively [Table 2, Graph 2].

### Age wise distribution in months

The age wise distribution of samples with ECC for 36, 48, 60, and 72 months was 44 (9.93%), 50 (11.29%), 110 (24.83%), and 239 (53.95%), respectively, and their mean dfs was 8.05, 10.0, 8.88, and 9.05, respectively. In order to test the significance between the age of child and prevalence of ECC, ANOVA test was used and the *P* value was found to be statistically not significant [Table 3, Graph 3].

### Gender comparison

Gender wise comparison of children with ECC was made. The number of boys with ECC was

**Table 1: Gender wise distribution of children**

Child gender	Frequency	Percent
Boys	1771	63.9
Girls	1000	36.1
Total	2771	100.0

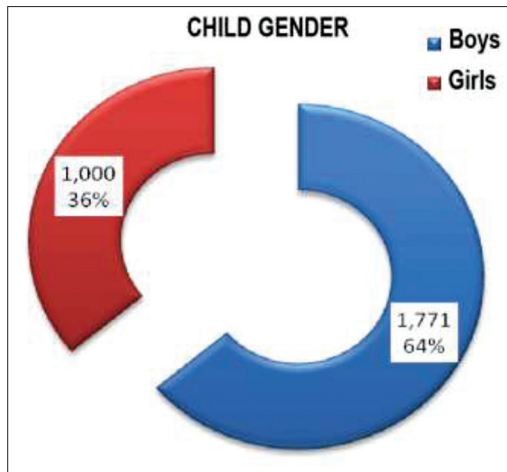
**Table 2: Area wise distribution of samples**

Place of residence	Frequency	Percent
Rural	1022	36.9
Semi-urban	1300	46.9
Urban	449	16.2
Total	2771	100.0

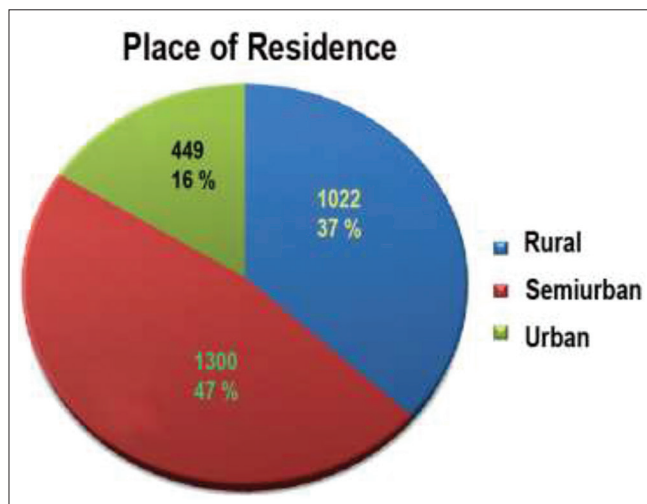
**Table 3: Age wise distribution of prevalence of ECC**

Age of child in months	<i>n</i>	%	Mean dfs	SD	<i>F</i>	<i>P</i>
36	44	9.93	8.05	3.94	1.819	0.143
48	50	11.29	10.00	4.78		
60	110	24.83	8.88	4.28		
72	239	53.95	9.05	3.90		
Total	443	100	9.01	4.12		

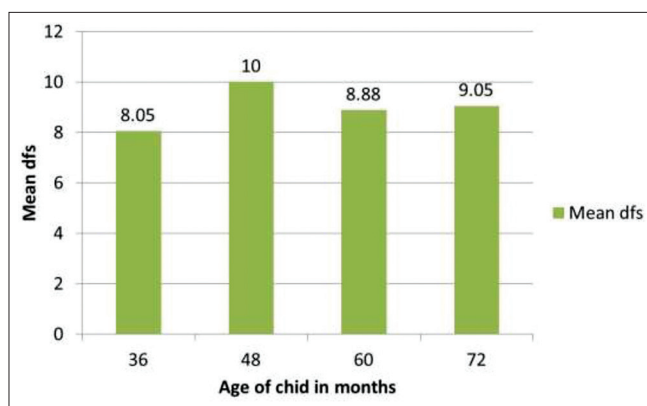
*P*>0.05, hence statistically not significant. ECC=Early childhood caries, SD=Standard deviation



Graph 1: Gender wise distribution of children



Graph 2: Area wise distribution of samples



Graph 3: Age wise distribution of prevalence of ECC

315 (71.11%), with a mean dfs of 8.85 and a standard deviation of 4.17, whereas in girls the number was 128 (28.89%) with a mean dfs of 9.41 and a standard deviation of 3.99, and the *P* value was statistically not significant [Table 4, Graph 4].

Gender of child	n	%	Mean dfs	SD	t	P
Boys	315	71.11	8.85	4.17	1.31	0.192
Girls	128	28.89	9.41	3.99		
Total	443	100	9.01	4.12		

*P*>0.05, hence statistically not significant. ECC=Early childhood caries, SD=Standard deviation

### SES of parents

When children with ECC was evaluated with the SES of their parents, 206 (46.50%) children were from low SES with a mean dfs of 10.74, 132 (29.80%) children were from medium SES with a mean dfs of 8.53, and 105 (23.70%) children were from high SES with a mean dfs of 6.24. Prevalence of ECC was high among children of low economic status and lowest among children of high economic status. ANOVA test was used and the *P* value was found to be statistically highly significant [Table 5, Graph 5].

### Parenteral education status

When the educational status of the parents of the children was evaluated, parents of 128 (28.89%) children with ECC were illiterate, with a mean dfs score of 9.67, 189 (42.66%) parents had school level education with a mean dfs of 8.98, and 126 (28.44%) parents had college level education with a mean dfs of 8.39. Thus, the prevalence of ECC was high among children with illiterate parents and was found to be the lowest among children with parental education at college level. ANOVA test was used and the *P* value was found to be statistically significant [Table 6, Graph 6].

### ECC and working mother

When children with ECC were evaluated with the working status of their mothers, 174 (39.28%) mothers were working, with a mean dfs of 10.47, and 269 (60.72%) mothers were not working, with a mean dfs of 8.07. ECC was found to be high among children whose mothers were working and lowest among children whose mothers were not working. *P* value was statistically highly significant indicating that ECC shows an increasing trend in children whose mothers are working [Table 7, Graph 7].

## DISCUSSION

The dental profession has to deal with one of the most widespread human maladies – dental caries.<sup>[11]</sup> Humanity has been plagued by the persistence of this very unique disease since prehistoric times.<sup>[12]</sup> This

disease can aptly be termed as a scourge of modern civilization and no nation or continent has escaped from its ill effects. It has been rightly called “the last epidemic.”<sup>[13]</sup>

Nursing caries is a form of rampant caries in the primary teeth of young children. The feature that distinguishes nursing caries as defined here from

classical rampant caries is the specified absence of lesions on the mandibular incisors, which are protected by the action of tongue and lower lip during feeding and by pooled sublingual saliva.<sup>[14]</sup>

The older terms “nursing caries” and “baby bottle tooth decay” are currently being replaced with a broader term ECC. This change has helped to focus our attention on the risk factors other than prolonged breast-feeding and bottle-feeding. Some researches have shown that factors other than inappropriate feeding methods may be important.<sup>[15,16]</sup> Definitions of ECC vary in the published literature, which makes comparisons among studies difficult.<sup>[17,18]</sup> Some definitions have included one or more maxillary incisors with decay,<sup>[19]</sup> two or more incisors with decay, and even three of four maxillary incisors with decay.<sup>[20,21]</sup>

The AAPD now defines ECC as the occurrence of at least one primary tooth affected by decay in a child under 6 years of age.<sup>[4]</sup> This consensus definition should help in advancing ECC research. The typical causative triad for caries consists of cariogenic microorganisms, fermentable carbohydrates, and a susceptible host, but a multitude of risk factors are involved in ECC development. ECC has been associated with SES, parental education, maternal nutrition, psychosocial issues, parenting practices, and ethnic variations.<sup>[18,22,23]</sup>

Application of different schemata for nursing caries to the same population yields different nursing prevalence rates.<sup>[6]</sup> Preschool oral health, especially nursing caries, is an overlooked aspect of childhood health and well-being.<sup>[24]</sup>

So, keeping these risk factors in mind, the present study was undertaken to evaluate the prevalence of ECC in

**Table 5: Prevalence of ECC compared with socioeconomic status**

Economic status	n	%	Mean dfs	SD	F	P
Low	206	46.50	10.74	3.08	52.842	0.00**
Medium	132	29.80	8.53	4.01		
High	105	23.70	6.24	4.39		
Total	443	100	9.01	4.12		

\*\*P<0.01, hence statistically highly significant. ECC=Early childhood caries, SD=Standard deviation

**Table 6: Prevalence of ECC in relation to educational status of parent**

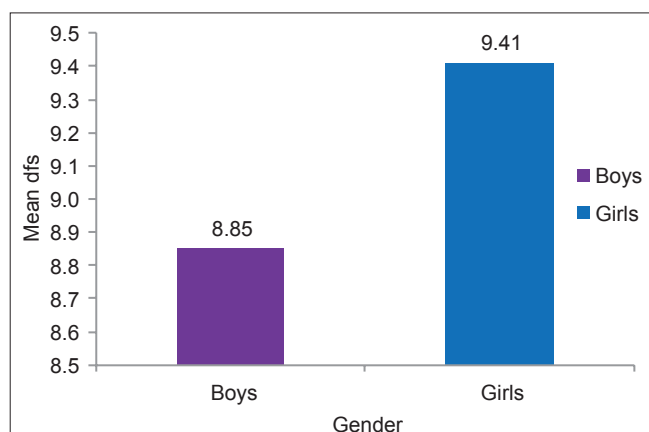
Parental education	n	%	Mean dfs	SD	F	P
Illiterate	128	28.89	9.67	4.13	3.119	0.045*
School level	189	42.66	8.98	4.02		
College level	126	28.44	8.39	4.19		
Total	443	100	9.01	4.12		

\*P<0.05, hence statistically highly significant, ECC=Early childhood caries, SD=Standard deviation

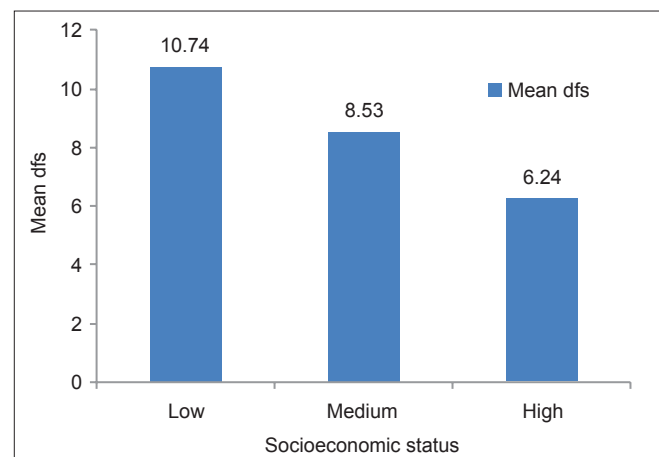
**Table 7: Prevalence of ECC in relation to mothers' working status**

Mothers' working status	n	%	Mean dfs	SD	t	P
Working	174	39.28	10.47	3.98	6.24	0.00**
Not working	269	60.72	8.07	3.94		
Total	443	100	9.01	4.12		

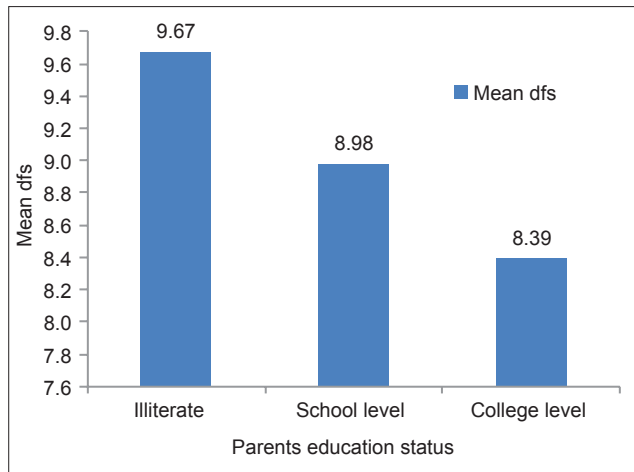
\*\*P<0.01, hence statistically highly significant, ECC=Early childhood caries, SD=Standard deviation



**Graph 4:** Gender wise distribution of ECC



**Graph 5:** Prevalence of ECC compared with socioeconomic status



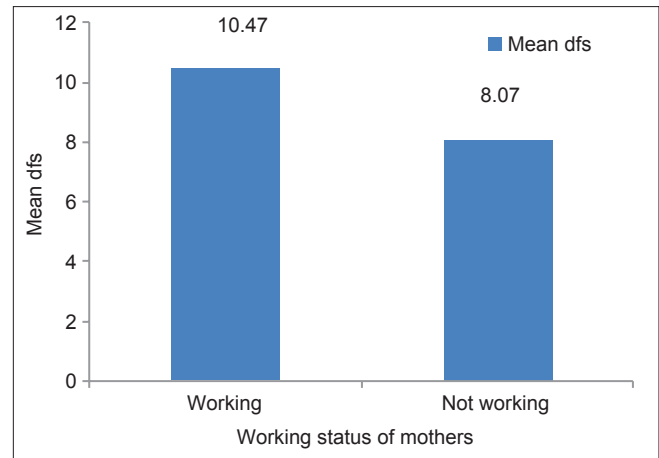
**Graph 6:** Prevalence of ECC in relation to educational status of parent

preschoolers from Salem, similar to a study conducted by van Palenstein Helderma *et al.*<sup>[24]</sup>

The prevalence of ECC in Salem was 16% with a mean dfs of  $5.23 \pm 1$ . The dfs in this study was found to be lower than the values reported by Harrison *et al.*,<sup>[22]</sup> Tyagi,<sup>[7]</sup> and Malvania and Krishnan.<sup>[25]</sup> The lower prevalence of ECC in Salem may be attributed to the fact that Salem is a fluorosis-endemic area.

### Relationship of ECC with age

The age-related trends have been reported in many studies, which could be due to the cumulative nature of dental caries. In this study, prevalence was lower in younger children and increased with age. In 36-month-old children, the prevalence was 9.93%, in 48-month-old children, it increased to 11.29%, in 60-month-old children, it still increased to 24.83%, and increased prevalence was seen in 72-month-old children (53.95%). In a national survey conducted in Great Britain, 17% of children were affected by nursing caries at the age of 1½–4½ years. Prevalence was lower in younger children, which was only 4% in 1½–2½ year old children, and increased with age, up to 30% in 3½–4 year old children.<sup>[26]</sup> It is apparent that given the ideal predisposing conditions, carious lesions can be initiated within a relatively short period of time after tooth eruption and can rapidly progress to cavitation. Weinstein *et al.*<sup>[27]</sup> have reported that incipient carious lesions could progress to cavitation within 6–12 months. Studies by Jose and King<sup>[28]</sup> have shown that maxillary anterior carious lesions can develop as early as 10–12 months of age. The pattern and extensiveness of decay follow the eruption pattern, with the exception of lower incisors because of their close proximity to the secretions of the submandibular salivary glands as well



**Graph 7:** Prevalence of ECC in relation to mothers' working status

as due to the cleansing action of the tongue during the process of suckling and deglutition.

Similar to the studies reported by Jose and King,<sup>[28]</sup> Tewari and Tewari,<sup>[29]</sup> and Mahejabeen *et al.*,<sup>[30]</sup> in this study also it was found that prevalence of ECC increased significantly with age. This could be explained by the increasing number of erupted primary teeth which become exposed to the oral environment and cariogenic challenge.

### Relation of ECC with gender

In this study it was observed that girls had higher prevalence of ECC than boys; however, this difference was not statistically significant. Similar reports by Ueda *et al.*,<sup>[31]</sup> Adekoya-Sofowora *et al.*,<sup>[32]</sup> de Carvalho *et al.*,<sup>[33]</sup> Wyne *et al.*,<sup>[14]</sup> and Abou El-Yazced *et al.*<sup>[34]</sup> also showed no significant difference in ECC prevalence between boys and girls.

### Relation of ECC with socioeconomic strata

Social class may also affect ECC risk in many ways. Individuals from lower economic strata experience financial, social, and material disadvantages that compromise their ability to care for themselves, obtain professional oral healthcare services, and live in a healthy environment, which leads to a reduced resistance to oral and other diseases.<sup>[28]</sup> The present study also showed caries prevalence to be highest in the low socioeconomic group.

The grouping of subjects according to the SES encompasses the influence of income, parental occupation, maternal education, and social environment.<sup>[35]</sup> Determination of social class is complicated, especially in developing countries like

India, where there are no specifically accepted criteria for the same.<sup>[30]</sup> In the present study, the children were divided into three groups based on the SES of the family. This is a modified classification of categorizing SES as reported by Tyagi.<sup>[7]</sup>

The present study showed that higher the income, lower is the ECC prevalence,<sup>[33]</sup> similar to that reported by other studies.<sup>[28,30,36]</sup> Low income affects the degree of education, health, values, lifestyles, and access to healthcare information, thereby increasing the susceptibility to caries.<sup>[12]</sup>

### Relation of ECC with parental education and mother's working status

Mothers are the primary caregivers for the child. High parental education is related to lower nursing caries prevalence.<sup>[28]</sup> The present study shows that those children whose parents had no schooling had significantly higher nursing caries experience. This finding is similar to other studies which showed a strong association between parental education and nursing caries experience.<sup>[37-39]</sup> Low level of maternal education contributes to the lack of information and education about the children's oral health care.<sup>[40]</sup> It is also been found that motivating an uneducated mother to engage in preventive programs is a difficult task.<sup>[28]</sup> Children of working mothers had low prevalence of ECC when compared to children of non-working mothers.

The prevalence of ECC in Salem was relatively lower when compared to other prevalence reports from India. This may be attributed to various factors like endemic fluorosis, use of fluoridated toothpaste, improved oral hygiene measures, and increase in awareness about the ill effects of improper feeding habits among school-going children. Although the overall prevalence was lower, it was comparatively higher in the rural areas of Salem than in the urban areas. In rural areas, the awareness level of oral hygiene and good feeding practices is very low.

Oral health care for children is not given importance in the state of Tamil Nadu. Therefore, educating and motivating caregivers and mothers of children in Salem on the preventive aspects of dental caries have to be stressed. It is essential to stress the importance of preventive measures to combat ECC. A stepwise preventive strategy should be planned at both individual and community levels and their effectiveness has to be re-evaluated by follow-up.

### Limitations

- As dental caries is a complex disease, many variables like parenteral attitude toward the child's oral health, supervision of oral health practices, and feeding habits when the child is outdoor should be considered
- Non-cavitated lesions were not recorded in our study.

### Future direction of the study

This study does not focus on the complex interrelationship of various factors of ECC and has pointed out the main reason for ECC. Assessment of other factors like frequency of snacking, use of tooth paste, drinking water source, birth order of the child, day care person, parenteral follow-up, etc., may be considered.

### Recommendations

- The results support the view that pediatric oral counseling should begin as early as 6 months before eruption of the first primary tooth
- Involvement of healthcare professionals to promote the recommended dietary advice and oral health education
- Educating the pregnant women and mothers to ensure that their own oral health is maintained and to start weaning for children at around 6 months of age
- Introduction of dental registration from birth.

### CONCLUSION

The following conclusions were drawn from this study:

- The prevalence of ECC in Salem was 16% with a mean dfs of  $5.23 \pm 1$  among the preschoolers aged between 36 and 72 months
- Prevalence of ECC was high among low SES group with a mean dfs of 10.74
- The children of working mothers had higher prevalence of ECC with a mean dfs of 10.47.

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