Prevalence and Risk-factors of Early Childhood Caries among 2–6-year-old Anganwadi Children in Nellore District, Andhra Pradesh, India: A Cross-sectional Survey

Abstract

Purpose/Objectives: The objective of this study is to study the prevalence and associated risk determinants of early childhood caries (ECC) among preschool children. Materials and Methods: A cross-sectional descriptive study was designed to assess the ECC prevalence and associated risk factors among preschool children in Anganwadi of Nellore district using a standardized questionnaire. Results: A total of 550 study participants of age 2–6 years are enrolled in this cross-sectional study. Mean age of the participants was 4.39 ± 0.89 years. Most of the study participants (38%) were in the age of 5 years. When gender wise comparison was made girls represented 62% and boys 38% of the total population. When the risk factors were assessed for their association with caries experience, socioeconomic status, mother’s schooling at child’s birth, duration of using bottle, and bottle feeding while sleeping and plaque scores showed significant association with caries experience. Conclusion: ECC was more prevalent among 5-year-old children as compared to other age groups and moreover demographic factors such as mother’s occupation, education, socioeconomic status, developmental characteristics such as enamel hypoplasia, feeding habits like prolonged and nocturnal bottle feeding and clinical parameters like plaque scores showed significant correlation with ECC.

Keywords: Bottle feeding, early childhood caries, enamel hypoplasia, gingivitis, plaque

Introduction

Early childhood caries (ECC) is a serious socio-behavioral and dental problem that afflicts infants and toddlers. ECC prevalence varies from population to population; however, children of disadvantaged subpopulations, regardless of race, ethnicity or culture, have been found to be most vulnerable. In England, the prevalence reported ranges from 6.8% to 12% and in the USA prevalence varies from 11.0% to 53.1%. In Asia, in the Far East region, which seems to have one of the highest prevalence and severity for the disease, the prevalence in 3-year-old ranges from 36% to 85%, while in India, a prevalence of 44% has been reported for caries in 8–48 months old.

ECC is a multi-factorial disease. The factors include a susceptible host, fermentable carbohydrate diet, presence of dental plaque, high number of cariogenic microorganisms such as mutans streptococci, lactobacillus, and time.

The prevalence of ECC and its association with feeding habits and oral hygiene practices in preschool children of Kerala state was evaluated by Jose and King in 2003. They concluded that children with poor oral hygiene, who consumed snacks, who were given snacks as reward, and those who belonged to lower socio-economic status had higher caries experience. Literature indicates that there is a strong association between enamel defects, prematurity, and low birth weight.

The children in Anganwadis mostly belong to the rural and urban slum areas with a marked lower level of socioeconomic status, poor-feeding conditions and dietary patterns, lower levels of education and health awareness among the parents, limited utilization of health-care facilities. Therefore, the burden of ECC is definitely high in this population. Hence, a community-based study is essential to reveal the true picture of this problem and to find out the associated factors for this problem.
Hence, this study was conducted with an aim to find out the prevalence of ECC, to determine the risk factors and their relationship to ECC among the children attending the Anganwadis of Nellore district.

**Materials and Methods**

**Source of data**

Data collected were primary in nature.

**Study design**

A cross-sectional descriptive study was designed to assess the ECC prevalence and associated risk factors among preschool children.

The study was conducted over a period of 1 month. Before the start of the study, Ethical clearance was obtained from institutional review board of Narayana Dental Institution.

**Sampling**

Children were recruited using multistage random sampling. At the first stage in Nellore district, 5 urban divisions were selected. At second stage in each division, 3 Anganwadi centers were selected using lottery method.

**Pilot study**

The questionnaire was standardized and checked for feasibility using a pilot study in two Anganwadi centers among 72 children, 36 in each center, respectively. These children were not included in the main study.

Sample size calculation was also done using prevalence determined from a pilot study using the formula with the prevalence of 67% as determined through pilot study and l as allowable error of 6% of p.

\[
 n = \frac{4pq}{l^2}
\]

p is the prevalence of the disease, q is 1-p

l is allowable error which is 6% of p

p was 67% obtained from pilot study, q = 33%, l = 4.02

substituting this values

\[
 n = \frac{4 \times 67 \times 33}{4.02 \times 4.02}
\]

n = 547, then approximately rounding off to n = 550

**Collection of data**

The protocol consisted of a dental examination and a standardized questionnaire. Parents or guardians were given an information leaflet, explaining the aim of the study and requesting their child’s participation, after which they were asked for signed consent. Only children with a completed questionnaire and parental signed consent were enrolled in the study.

**Dental examination**

Clinical assessments were carried out by using a drying tooth device, a plane mirror, and a WHO-Community Periodontal Index probe. Caries was recorded when a lesion at the enamel level and dentinal level was observed.\[^{12}\] Plaque was assessed using plaque control record index of O’Leary et al.\[^{13}\] The examiner was received training and instruction before the start of the study. The examiner was calibrated for plaque and caries detection by examining 10 children younger than 6 years old. The reliability was assessed with kappa statistics (Cohen’s kappa=0.86) which means that scores of the examiner are in almost perfect agreement.

The questionnaire included the variables of a model which were selected from those reported to have an association with ECC in previous studies. Questionnaire was checked for validity and reliability. Validity was checked using face validity by giving questionnaire to 5 school teachers well versed in both English and Telugu languages to check whether translation for each question from English to Telugu is correctly done or not, their remarks were noted and subsequently modified in the final questionnaire. Reliability of questionnaire was assessed using test-retest design by distributing questionnaire to 5 school teachers to fill the form twice with 7 days apart and analyzed using Cronbach’s alpha statistics which was 0.78 showing significant correlation.

**Data analysis**

Data were calculated by descriptive statistics using SPSS version 16 software for Windows. The association between ECC and background factors was tested using the Chi-square test. Logistic and linear regression analysis was done to identify the association between risk factors with caries experience.

**Results**

A total of 550 study participants of age 2–6 years are enrolled in this cross-sectional study. Mean age of the participants was 4.39 ± 0.89 years. Most of the study participants (38%) were in the age of 5 years. When gender-wise comparison was made girls represented 62% and boys 38% of the total population [Table 1].

Questionnaire was divided into 5 levels. Level 1 was based on socioeconomic and demographic variables of the participants and their parents/caregivers.

Study participants were also categorized based on socioeconomic status. Most of them were in upper middle class (61%), followed by upper lower (34%) and lower class (5%) respectively based on Kuppuswamy scale\[^{14}\] [Table 2]. This scale was originally developed in 1976. It is the summation of education, occupation and income. It is used for urban areas.
Most (46%) of the mothers reported that they used bottle for night feeding. Moreover, height of the 65% of the children at 2 years was ≥2 feet.

Level 4 indicated oral health-related behaviors between 2 and 5 years of age. Majority of mothers (72%) gave food sometimes for their children before going to bed. Frequency of sweet consumption was divided into three subcategories ≥1 time/day (25%), <1 time/day (34%), and never (41%). Soft drink consumption was also similarly divided constituting ≥1 time/day (27%), <1 time/day (24%), and never (49%).

Eighty-eight percent of the study participants reported that they were brushing ≥1 time/day and always used toothpaste for brushing and 99% of them had never visited dentist earlier for any type of treatment [Table 3].

Clinical parameters were assessed using O’Leary plaque Index,[13] def, defs Index (1944),[15] and WHO Pro forma (1997).[16] Logistic regression analysis had been done to assess the association between risk factors and dental caries experience. Age of 5 years of the study participants had higher odds of developing caries as compared to other age groups (odds ratio [OR]: 0.87) and mother’s occupation as nonprofessional had higher odds for developing caries (OR: 2.68) [Table 4].

Linear regression model was constructed to assess the association between risk factors and dental caries. Socioeconomic status, mother’s schooling at child’s birth, duration of using bottle, and bottle feeding while sleeping and plaque scores showed significant association with caries experience [Table 5].

**Discussion**

Dental caries is an infectious microbiological disease with multifactorial etiology. Paternal and maternal variables are included as model 1. Among the maternal variables age group of 24–29 years and nonprofessional occupation had higher odds for developing caries which reinforces the stronger mother-child correlation. A strong association between mother’s education and presence of caries in their children was also observed in studies reported by Zhou et al.,[17] Jose and King,[8] Hallett and O’Rourke,[18] Livny and Sgan-Cohen.[19]

Age of the child showed significant correlation with ECC. Five years of age group had higher odds for developing caries when compared with other age groups. Hallett and O’Rourke[18] concluded that with increasing age there is an increase in caries development due to prolonged exposure of primary teeth to the oral environment. Furthermore, as children grow older there is a change in the dietary habits and hygiene practices which increases the risk for caries initiation. However, Gaidhane et al.[23] reported that there was no significant association between age of the child and ECC progression.
Table 3: Distribution of children based on risk factors

| Questions                                           | No of children | % of children |
|-----------------------------------------------------|----------------|---------------|
| Gender                                              |                |               |
| Male                                                | 210            | 38.18         |
| Female                                              | 340            | 61.82         |
| Mother’s age at child’s birth                       |                |               |
| 18-23 years                                         | 467            | 84.91         |
| 24-29 years                                         | 80             | 14.55         |
| >30 years                                           | 3              | 0.55          |
| Fathers age at child’s birth                        |                |               |
| 19-24 years                                         | 331            | 60.18         |
| 25-30 years                                         | 201            | 36.55         |
| >31 years                                           | 18             | 3.27          |
| Mother’s occupation at Child’s birth                |                |               |
| Employer/professional                               | 9              | 1.64          |
| Employee/non-professional                           | 69             | 12.55         |
| Unemployed                                          | 472            | 85.82         |
| Father’s occupation at Child’s birth                |                |               |
| Employer/professional                               | 127            | 23.09         |
| Employee/non-professional                           | 420            | 76.36         |
| Unemployed                                          | 3              | 0.55          |
| Mother’s schooling at child’s birth                 |                |               |
| Below 10th class                                    | 347            | 63.09         |
| Intermediate                                       | 120            | 21.82         |
| Degree                                              | 3              | 0.55          |
| Illiterate                                          | 80             | 14.55         |
| Fathers schooling at child’s birth                  |                |               |
| Below 10th class                                    | 300            | 54.55         |
| Intermediate                                       | 162            | 29.45         |
| Degree                                              | 30             | 5.45          |
| Illiterate                                          | 58             | 10.55         |
| Weight at birth                                     |                |               |
| >2500 gms                                           | 471            | 85.64         |
| ≤2500 gms                                           | 79             | 14.36         |
| Gestational age                                     |                |               |
| >37 weeks                                           | 473            | 86            |
| ≤37 weeks                                           | 77             | 14            |
| Mode of delivery                                    |                |               |
| Vaginal birth                                       | 455            | 82.73         |
| Caesarean birth                                     | 95             | 17.27         |
| Enamel hypoplasia                                   |                |               |
| Yes                                                 | 22             | 4             |
| No                                                  | 528            | 96            |
| Total                                               | 550            | 100           |
| Duration of breastfeeding                           |                |               |
| ≥1 year                                             | 424            | 77.09         |
| <1 year                                             | 123            | 22.36         |
| Never breastfed                                     | 3              | 0.55          |
| Frequency of using bottle                           |                |               |
| >3 times/day                                        | 89             | 16.18         |
| ≤3 times/day                                        | 273            | 49.64         |
| No bottle feeding                                   | 188            | 34.18         |
| Duration of using bottle                            |                |               |
| ≥2 years                                            | 61             | 11.09         |

Contd.....

Low socioeconomic status showed statistically significant correlation with caries prevalence. Individuals from lower economic strata experience financial, social, and material disadvantages that compromise their ability to care for themselves, obtain professional oral health-care services and live in a healthy environment, all of which lead to reduced resistance to oral and other diseases as described by Jose and King.[6]

Model 2 describes child developmental characteristics at 2 years of age. Enamel hypoplasia showed significant association with ECC development.[20] Rythén et al.[21] concluded that prematurely born children had experienced poor mineralization of the teeth and poorer oral health, henceforth supporting the evidence of the role played by enamel defects in the development of ECC.

In Model 3, children with prolonged and nocturnal bottle feeding practices had a significant correlation with ECC. al Ghanim et al.,[22] Creedon and O’Mullane,[23] and Hallet
Table 4: Logistic model for association between caries and risk factors

| Factors                        | Estimate | SE  | P         | OR   | 95.0% C.I for OR Lower | Upper |
|--------------------------------|----------|-----|-----------|------|------------------------|-------|
| Model                          | Age groups |     |           |      |                        |       |
|                                | 2 Years   | -0.81 | 0.24 | 0.0010* | 0.45 | 0.28 | 0.71 |
|                                | 3 Years   | -0.64 | 0.15 | 0.0001* | 0.53 | 0.39 | 0.71 |
|                                | 4 Years   | -0.15 | 0.15 | 0.3270 | 0.87 | 0.65 | 1.16 |
|                                | 5 Years   | -0.25 | 0.29 | 0.3980 | 0.78 | 0.44 | 1.38 |
|                                | 6 years   |       |       |        |      |      |      |
| Mother's occupation at Child's birth | Unemployed | 1.00 |       |      |      |      |      |
|                                | Professional | -0.32 | 0.72 | 0.6560 | 0.73 | 0.18 | 2.98 |
|                                | Non-professional | 0.99 | 0.28 | 0.0001* | 2.68 | 1.56 | 4.59 |

*P<0.05

Table 5: Multiple linear regression model for caries

| Independent variables | SE  | t     | P         |        |
|-----------------------|-----|-------|-----------|--------|
| Intercept             | 1.036 | -1.8797 | 0.0607 |        |
| Age                   | 0.042 | -0.5763 | 0.5647 |        |
| SES                   | 0.1168 | 4.6924 | 0.0001* |        |
| Gender                | 0.2366 | -1.5488 | 0.122 |        |
| Plaque scores         | 0.0021 | 20.7614 | 0.0001* |        |
| Mother's age at child's birth | 0.1408 | -0.4071 | 0.6841 |        |
| Father's age at child's birth | 0.1167 | 1.8318 | 0.0676 |        |
| Mother's occupation at child's birth | 0.1055 | 0.8824 | 0.378 |        |
| Father's occupation at child's birth | 0.0943 | 1.0919 | 0.2754 |        |
| Mother's schooling at child's birth | 0.0405 | -3.0331 | 0.0025* |        |
| Father's schooling at child's birth | 0.0388 | -1.4209 | 0.1559 |        |
| Duration of breastfeeding | 0.185 | 1.386 | 0.1663 |        |
| Frequency of using bottle | 0.2369 | 0.7635 | 0.4455 |        |
| Duration of using bottle | 0.0689 | -3.0453 | 0.0024* |        |
| Bottle feeding while sleeping | 0.0667 | 1.9737 | 0.0499* |        |
| Height for age 2 years | 0.0906 | 0.0674 | 0.9463 |        |
| Eating before going to bed | 0.0834 | 1.3106 | 0.1906 |        |
| Sweet consumption      | 0.0665 | 2.1748 | 0.0301* |        |
| Soft drink             | 0.0673 | -1.6715 | 0.0952 |        |
| Frequency of tooth brushing | 0.1109 | -1.1114 | 0.2669 |        |
| Use of toothpaste      | 0.118 | -0.758 | 0.4488 |        |
| Dental visit before    | 0.4087 | 0.226 | 0.8213 |        |

R=0.8899, R²=0.7919, Adjusted R²=0.7824. F (24,525)=83.277, P<0.0010 Std. Error of estimate: 0.84839

and O'Rourke[18] described that this can be due to the length of time the fermentable contents of bottle remain in contact with teeth.

Model 5 describes that Plaque scores showed significant correlation with ECC. Plaque acts as a reservoir for supply of nutrients to bacteria and prevents buffering of acids by regulating the flow of ions across the membrane, hence leading to increase in progression of caries Mohebbi et al.[24]

In the present study, nonexistent filled component among children indicates high unmet restoration needs. Naidu et al.[25] described that accessibility and symptom-based attendance for dental care are the major barriers which hinder prevention of ECC at earlier stage.

Conclusion
ECC was more prevalent among 5-year-old children as compared to other age groups and moreover demographic factors such as mother’s occupation, education, socioeconomic status, developmental characteristics such as enamel hypoplasia, feeding habits like prolonged and nocturnal bottle feeding and clinical parameters like plaque scores showed significant correlation with ECC. Hence, there is a need to focus on parents, school teacher’s and care provider’s education about early detection, prevention aspects of dental caries. Dental health services should be made available in the peripheral areas to meet the needs of future generation.

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Conflicts of interest
There are no conflicts of interest.

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