

# Association of Early Childhood Caries with Feeding, Dietary Habits, and Oral Hygiene Practices among Rural and Urban School Children of Jaipur

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## ABSTRACT

**Aim:** To determine possible associations of early childhood caries (ECC) with risk factors such as feeding and dietary habits of children and oral hygiene practices by the parents or caregiver in rural and urban school children in Jaipur, India.

**Materials and methods:** An observational cross-sectional study was designed with a dental examination and a standardized questionnaire. A total of 1,824 children, that is, 848 (46%) rural, and 976 (54%) urban school children were enrolled in the study. The data regarding their diet and feeding habits of children, oral hygiene practices of the parents or caregivers were collected with the help of a standardized questionnaire. The caries status of rural and urban school children was recorded using the decayed, missing, filled teeth (DMFT) index. Data thus collected were compiled, analyzed and were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS v 26.0, IBM). Comparison of frequencies of categories of variables with groups was done using Chi-square test with  $p < 0.05$  was considered to be statistically significant.

**Results:** The prevalence of ECC was 34.7% in rural and 45.5% in urban school children of Jaipur ( $p < 0.01$ ). Caries risk increased with the use of both bottle and breast feeding, habit of milk at night, eating snacks between meals with no habit of rinsing teeth, and decrease in parental supervision during oral hygiene practices. In urban school children there is an increased access to junk food and refined sugar daily as compared to rural school children with more than two times in a week was found statistically highly significant in the study ( $p < 0.01$ ).

**Conclusion:** The prevalence of ECC was higher in urban school children as compared to rural school children in Jaipur. It was found that risk factors such as diet and feeding habits of children and oral hygiene practices by the parents or caregiver are strongly associated with the prevalence of ECC. It was concluded that the epidemiological data, which have been collected in a very comprehensive way can be utilized more effectively to eliminate the root cause of the disease by improving oral health services in the rural and urban school children in Jaipur, India.

**Keywords:** Early childhood caries, Dietary habits, Feeding habits, Oral hygiene practices, Risk factors of early childhood caries, Rural and urban areas of Jaipur.

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## INTRODUCTION

Oral health is one of the most significant components in the normal development of a child. Oral health problems or illnesses can unfavorably influence quality of life and have a direct or an indirect impact on general health and future development of a child.<sup>1</sup> Dental caries which is untreated in deciduous teeth was the tenth most common condition, influencing 621 million youngsters around the world.<sup>2</sup> Due to active and uncontrolled dental caries, numerous kids have deficient oral and general health.<sup>3</sup> Data from the National Health and Nutrition Examination Survey, 2011–2012, show that among children aged 2–8 years, 37% had dental caries in their primary teeth. According to the reaffirmed insights by the United States Surgeon General's report in 2016, among children and adolescents dental caries is 4–5 times more common than asthma.<sup>4</sup>

Early childhood caries is a multifactorial disease. There are unique risk factors for ECC such as diet and feeding habits of children, socioeconomic and educational status of the family, oral hygiene practices of the mother or caregiver, demographic characteristics, parental attitudes, temperament of the child, mouth breathing habit, siblings, pacifiers dipped in honey, children with chronic illness or special health care needs, and maternal nutrition.<sup>5</sup>

Early childhood caries is a diet induced disease characterized by early onset and rapid progression.<sup>6</sup> It is considered to be a multifactorial etiologic process and this term is used to represent any type of caries in babies and preschool children. It is also

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associated with abnormal dietary practices and is characterized by a devastating infectious challenge.<sup>7</sup> It is a serious public health burden, medically, socially, and financially.<sup>8</sup> As seen in many cases, it is initiated and aggravated by inappropriate feeding with a nursing bottle.<sup>9</sup>

There is conflicting debate on prevalence and severity of caries in rural and urban children with dual risk of malnutrition. There is a lack of accurate data or exact information on prevalence of ECC both at national and local levels. In spite of preventive measures and awareness, prevalence rate of ECC is steadily increasing in our country. So, significant attention should be given to primary teeth. This study would provide a baseline data to setup an effective preventive program in the future.

## AIMS AND OBJECTIVES

To determine possible associations of ECC with risk factors such as feeding, dietary habits, and oral hygiene practices by their parents/caregivers among rural and urban school children in Jaipur, India.

## MATERIALS AND METHODS

The present epidemiological study was conducted to determine association of ECC in children between 2 and 6 years of age in rural and urban school children in Jaipur with related risk factors such as feeding and dietary habits of children and oral hygiene practices by the parents/caregivers.

The sample size was calculated using the Epi Info 7.0 software program. It was estimated that a minimum sample size of 900 children was required to achieve a level of precision with a standard error of 4% or less. Considering this, a sample size of 1,800 children was taken, divided into two groups viz. 900 rural and 900 urban children and further subgrouped depending on private or government schools based on the list provided by government authorities. A list of government and private schools each, in urban as well as rural areas, was procured from the office of Deputy Director of Education Department, Jaipur District (Shiksha Adhikari).

By simple random sampling, 10 government and 10 private schools had been selected in urban area and 10 government and 10 private schools had been selected in rural area from the procured list. By this, we have achieved separate data of ECC for rural and urban school children in Jaipur. Ethical clearance was obtained from the Ethical Committee Mahatma Gandhi Dental College and Hospital (MGDCH/Dental/2020/03/11) before initiation of the study. The school authorities were consulted and those who agreed to take part in the study were selected by taking consent from them.

### Clinical Dental Examination of the Children

A visit was done in selected urban and rural schools/kindergarten to do clinical dental examination of the children. A proforma was made to record the dental caries experience of the primary dentition of the children. The DMFT index given by Greubbell in 1944 was used to record dental caries in the children.

The examination for dental caries was made by a single examiner, that is, the investigator herself in order to avoid bias. During the examination, the older children were seated on a chair or in standing position and the younger children were examined with the assistance of their parents, by means of the "knee-to-knee" technique.

### Questionnaire Survey/Comprehensive Interview with the Parents/Caregivers

Data regarding various risk factors for ECC in the children were assessed during a visit in selected urban and rural schools/kindergarten by using a structured predesigned

questionnaire survey form prepared in English and local/regional language (Hindi) to avoid linguistic barriers, with the help of WHO Oral Health Assessment Form (2013).

The questionnaire consisted of three domains, that is, feeding habits, dietary habits of the child, and oral hygiene practices by the child/parents/caregivers. Thus, the information regarding various risk factors for ECC in the children was collected between urban and rural school children.

The feeding habits were recorded using self modified questionnaire from Infant Feeding Practices Study II, conducted by Food and Drug Administration and Centers for Disease Control and Prevention.<sup>10</sup> This domain includes questions about child's manner of feeding, duration and frequency of breast/bottle feeding, duration and frequency of feeding at night, and the commencement of cup drinking/semisolids/solids.

The dietary habits were recorded for sucrose consumption according to the method described by Nizel and Papas.<sup>11</sup> This domain includes dietary and nutritional related questions regarding the form and frequency of different food consumption by the child with a close ended questionnaire.

The oral hygiene practices by the child/parents/caregivers include questions related to child's method and frequency of cleaning the oral cavity. It also records the brushing with or without adult assistance, oral hygiene methods practiced both before and after tooth eruption.

The investigator herself recorded the answers of all the questions in questionnaire in order to minimize misrepresentation of question and to ensure uniformity in the data recorded. Immediately after survey, a health talk/program (Fig. 1) was given in local language to focus on increasing awareness about maintenance of oral health in children (Fig. 2).

### Statistical Analysis

Data thus collected were compiled, analyzed with MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, WA, United States) and a master chart was created for the purpose of data analysis. Data were subjected to statistical analysis using SPSS v 26.0 (IBM). Comparison of frequencies of categories of variables with groups was done using Chi-square test. For all the statistical tests,  $p < 0.05$  was considered to be statistically significant, keeping a error at 5% and  $\beta$  error at 20%, thus giving a power to the study as 80%.



Fig. 1: A health talk about oral hygiene in children

## RESULTS

The present epidemiological study was conducted to determine the association of ECC in children between 2 and 6 years of age in rural area and urban area school children in Jaipur with related risk factors such as feeding and dietary habits of children and oral hygiene practices by the parents or caregiver. It showed that out of 1,824 school children examined, there were 848 (46%) in rural area and 976 (54%) in urban area of school children. The overall prevalence of ECC with 34.70% in rural area and with 45.50% in urban area was noticed in urban area and rural area school children of Jaipur. There was a statistically highly significant difference seen for the frequencies between the groups ( $p < 0.01$ ). It shows that there is high prevalence rate of ECC in urban area school children as compared to rural area school children of Jaipur. **Figure 3** shows overall prevalence of ECC area wise in school children of Jaipur.

**Table 1** depicts child having habit of milk at night and its association with prevalence of ECC in rural area and urban area school children. The child having a habit of consuming milk at night showed a high prevalence of ECC with a statistically highly

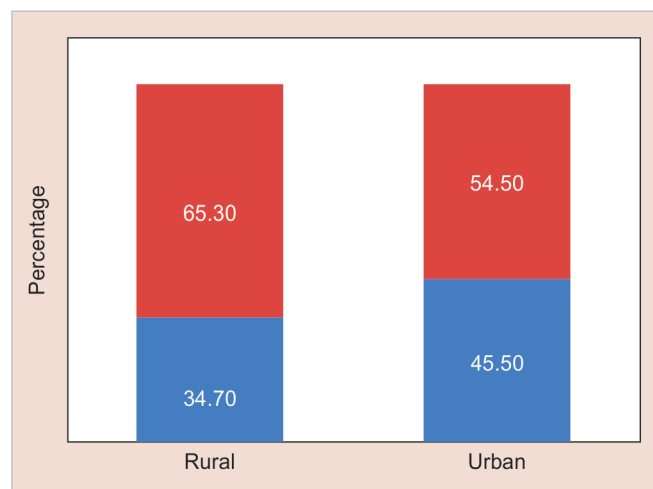
significant difference seen for the frequencies between the groups ( $p < 0.01$ ) in rural area as well as urban area school children.

**Table 2** and **Figure 4** show the frequency of child feeding with breast or bottle at night and its association with prevalence of ECC in rural area and urban area school children. The child having a habit of one or two times feeding with breast or bottle at night showed high prevalence of ECC with a statistically highly significant difference seen for the frequencies between the groups ( $p < 0.01$ ) in rural area as well as urban area school children.

**Table 3** depicts various eating or drinking foods consumed by the child and its association with prevalence of ECC in rural area and urban areas in school children. The child who never consumed fresh fruits/juices, jam/honey, chewing gum containing sugar with the habit of eating biscuits, cakes, sweets/chocolates, drinking soft drinks more than two times in a week showed high prevalence of ECC in rural area. The children in urban area who never consumed jam/honey, chewing gum containing sugar and who consumed fresh fruits/juices one to two times/week with the habit of daily eating biscuits, cakes, drinking soft drinks, sweets/chocolates showed high prevalence of ECC. It showed a statistically highly



**Fig. 2:** Distribution of education to the children



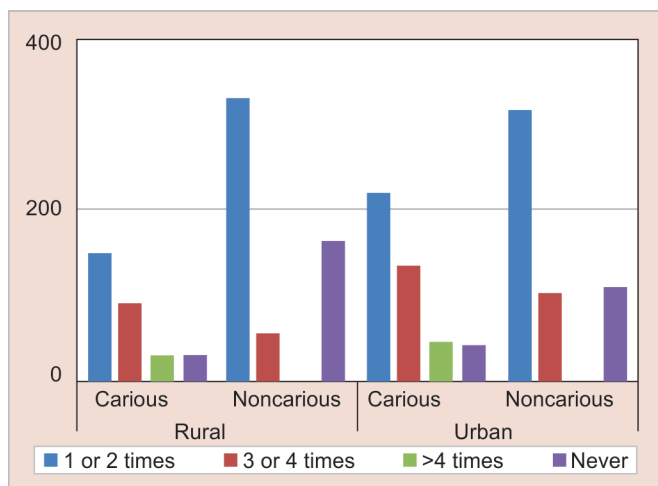
**Fig. 3:** Overall prevalence of ECC in school children of Jaipur

**Table 1:** Child having habit of milk at night and its association with prevalence of ECC in rural area and urban area school children

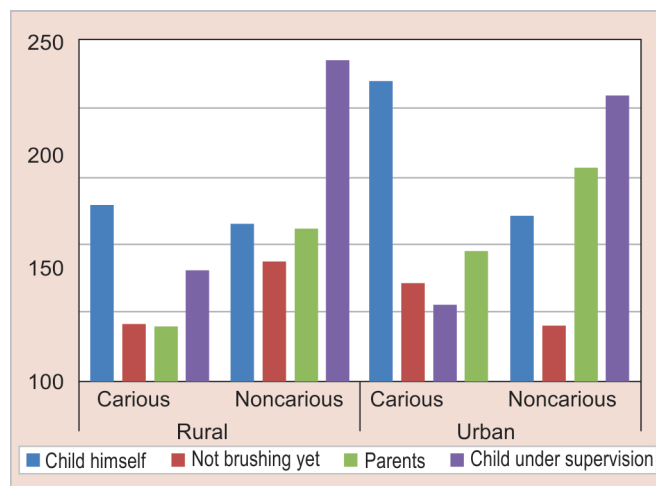
Habit of milk at night	Rural area		Urban area		Total
	Cariou	Noncariou	Cariou	Noncariou	
No	28	166	44	106	344
Yes	266	388	400	426	1,480
Total	294	554	444	532	1,824
$X^2 = 45.604, p\text{-value} = 0.000$ (highly significant)			$X^2 = 19.097, p\text{-value} = 0.000$ (highly significant)		

**Table 2:** Frequency of child feeding with breast or bottle at night and its association with prevalence of ECC in rural area and urban area school children

Frequency of child feeding with breast or bottle at night	Rural area		Urban area		Total
	Cariou	Noncariou	Cariou	Noncariou	
1 or 2 times	150	334	222	322	1,028
3 or 4 times	88	54	134	104	380
>4 times	28	0	44	0	72
Never	28	166	44	106	344
Total	294	554	444	532	1,824
$X^2 = 139.202, p\text{-value} = 0.000$ (highly significant)			$X^2 = 85.961, p\text{-value} = 0.000$ (highly significant)		



**Fig. 4:** Frequency of child feeding with breast or bottle at night and its association with prevalence of ECC in rural area and urban area school children



**Fig. 5:** Cleaning of child's teeth and its association with prevalence of ECC in rural area and urban area school children

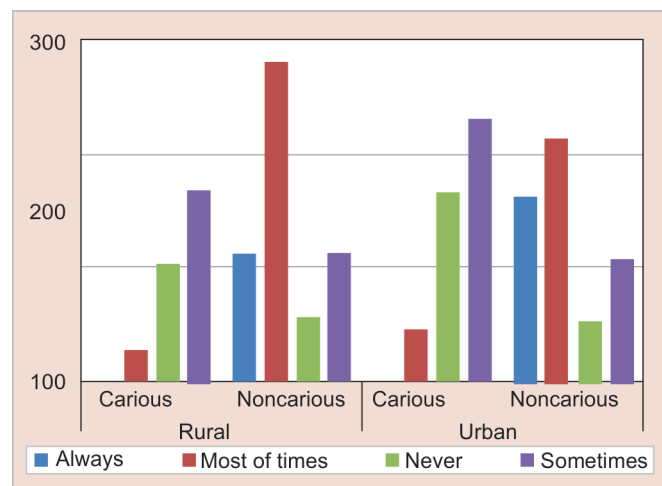
**Table 3:** Various eating or drinking foods child consuming and its association with prevalence of ECC in rural area and urban area school children

	Rural area		Urban area		Total
	Cariou	Noncarious	Cariou	Noncarious	
<i>Fresh fruits/juices</i>					
> 2 times/week	0	220	0	210	430
1-2 times/week	118	278	224	214	834
Daily	0	56	0	108	164
Never	176	0	220	0	396
$X^2 = 482.679, p\text{-value} = 0.00$ (highly significant)		$X^2 = 535.452, p\text{-value} = 0.00$ (highly significant)			
<i>Biscuits/cake</i>					
>2 times/week	146	54	178	158	536
1-2 times/week	60	334	44	216	654
Daily	88	54	222	104	468
Never	0	112	0	54	166
$X^2 = 346.708, p\text{-value} = 0.00$ (highly significant)		$X^2 = 206.862, p\text{-value} = 0.00$ (highly significant)			
<i>Sweets/chocolates</i>					
>2 times/week	148	166	132	212	656
1-2 times/week	0	332	2	212	546
Daily	146	56	310	108	622
$X^2 = 326.002, p\text{-value} = 0.00$ (highly significant)		$X^2 = 317.489, p\text{-value} = 0.00$ (highly significant)			
<i>Soft drinks</i>					
>2 times/week	116	56	176	106	454
1-2 times/week	60	276	46	212	594
Daily	88	0	222	52	362
Never	30	222	0	162	414
$X^2 = 347.660, p\text{-value} = 0.00$ (highly significant)		$X^2 = 347.886, p\text{-value} = 0.00$ (highly significant)			
<i>Jam/honey</i>					
Never	270	548	404	504	1,726
1-2 times/week	24	6	40	28	98
$X^2 = 59.887, p\text{-value} = 0.00$ (highly significant)		$X^2 = 738.513, p\text{-value} = 0.00$ (highly significant)			
<i>Chewing gum containing sugar</i>					
Never	278	544	412	514	1,748
1-2 times/week	16	10	32	18	76
$X^2 = 750.633, p\text{-value} = 0.00$ (highly significant)		$X^2 = 770.484, p\text{-value} = 0.00$ (highly significant)			

**Table 4:** Child under supervision while performing dental hygiene practices and its association with prevalence of ECC in rural area and urban area school children

Child under supervision while performing dental hygiene practices	Rural area		Urban area		Total
	Carious	Noncarious	Carious	Noncarious	
Always	0	110	0	160	270
Most of times	28	280	44	214	566
Never	100	54	170	52	376
Sometimes	166	110	230	106	612
Total	294	554	444	532	1,824

$\chi^2 = 293.176, p\text{-value} = 0.00$  (highly significant)  $\chi^2 = 377.328, p\text{-value} = 0.00$  (highly significant)



**Fig. 6:** Child under supervision while performing dental hygiene practices and its association with prevalence of ECC in rural area and urban area school children

significant difference seen for the frequencies between the groups ( $p < 0.01$ ) in rural area and urban area school children.

Figure 5 shows cleaning of child’s teeth and its association with prevalence of ECC in rural area and urban area school children. The children who have the habit of cleaning their teeth by themselves showed high prevalence of ECC with a statistically highly significant difference seen for the frequencies between the groups ( $p < 0.01$ ) in rural area and urban area school children.

Table 4 and Figure 6 show the child under supervision while performing dental hygiene practices and its association with prevalence of ECC in rural area and urban area school children. The parents who sometimes supervise their children while performing dental hygiene practices showed high prevalence of ECC with a statistically highly significant difference seen for the frequencies between the groups ( $p < 0.01$ ) in rural area and urban area school children.

## DISCUSSION

Early childhood caries has a lasting detrimental impact on the dentition. Over the past 2 decades, due to increasing parental knowledge, improved oral hygiene, lowering of sugar consumption, use of fluoridated toothpaste, effective utilizing of oral health services, and establishment of school based preventive programs, many developed countries experienced dramatic decline in dental caries and improved health of children. They considered the primary risk factor to be the utilization of nap time bottle that contains a fermentable carbohydrate food. On the contrary, the prevalence

and severity of dental caries have been increasing, relatively unexplored, and poorly defined in several developing countries, especially in those countries where preventive programs have not been implemented.

In these exciting times of rapid knowledge generation in the oral health domain, accurate caries risk assessment at the population level and “precision dentistry” at the person level are both desirable and achievable. For monitoring the trends of dental caries and for assessing the dental needs in a community, epidemiological surveys play a significant role and are essential for the development and implementation of effective oral health care programs. Therefore, there is a continuous demand to estimate the caries severity and its associated risk factors in a community.<sup>12</sup>

It was observed that out of 1,824 children examined, 40.4% children reported with caries. The rural area presented with the ratio of 34.70% whereas this ratio was 45.50% in urban area. It showed that there is higher prevalence of ECC in urban school children as compared to rural school children in Jaipur, despite of better education, knowledge, and resources in urban areas. This higher prevalence of ECC among urban children can be attributed to their increased access to junk food and refined sugar as compared to rural children.<sup>13</sup> Similar findings were seen in a study by Tsang et al.,<sup>13</sup> Pal et al.,<sup>14</sup> and with contrary results by Al-Rafee et al.,<sup>15</sup> Zhang et al.,<sup>16</sup> and Lindholm et al.<sup>17</sup>

Manner of feeding had a positive correlation with ECC in rural areas. The rationale behind this finding is the prolonged usage of baby bottle with sugar content at bedtime, specifically lactose. Although, breastfeeding provides the perfect nutrition for an infant, frequent and continuous contact of tooth enamel and human milk has been seen to lead to acidogenic conditions and resultant softening of enamel. Similar results were found in studies by Panwar et al.<sup>18</sup> with contrary results by Prakash et al.<sup>5</sup> and Dini et al.<sup>19</sup>

The habit of drinking milk at night and frequency of child feeding with breast or bottle at night showed a statistically significant relation with ECC ( $p < 0.01$ ). This decrease in salivary flow and change in swallow reflex pattern at the time of child’s sleep allows high carbohydrate liquid to remain in the mouth and pull around the child’s teeth which leads to caries.<sup>18</sup> Similar findings were found in studies by Tyagi et al.<sup>20</sup> and Mohamed and Barnes.<sup>21</sup>

A strong association was found between dietary habits of the child and prevalence of ECC with a statistically highly significant difference ( $p < 0.01$ ) in the study. Children with a habit of eating biscuits, cakes, sweets/chocolates, drinking soft drinks more than two times in a week in rural areas and daily in urban areas showed the highest prevalence of ECC. Similar findings were found in studies by Tsang et al.,<sup>13</sup> and Pal et al.<sup>14</sup> This might be due to consumption of sucrose containing food in high frequency which leads to increase

in acidogenicity of plaque along with establishment and the growth of *Streptococcus mutans* for formation of caries.<sup>22</sup> Similar findings were found in studies by Vandana et al.<sup>23</sup> and Barjatya et al.<sup>24</sup>

Oral hygiene practices of the child and ECC presented with a statistically significant difference ( $p < 0.01$ ) in the study. Similar findings were found in studies by Mazhari et al.<sup>22</sup> and Neena et al.<sup>25</sup> According to our study, caries prevalence was less in patients who performed oral hygiene practices with parental supervision. Similar findings were found in studies by Hallet and O'Rourke<sup>26</sup> and Carino et al.<sup>27</sup> In contrast with the study by Febres et al.<sup>28</sup> and Milgrom et al.<sup>29</sup> showed no association between oral hygiene practices of the child and prevalence of ECC. The oral hygiene supervision is more important than the frequency of tooth brushing to have good oral hygiene quality.<sup>22</sup>

The limitations of this study are that this population is relatively inaccessible because the disease occurs at such a young age with children having limited mouth opening and less cooperation level especially between 2 and 3 years of age and it is very difficult to record the prevalence of the problem on a true population basis. Some alteration in result could also be due to the fact that it is a cross-sectional study, in which the cause-effect relationship cannot be known because the data regarding the associated risk factors and outcomes are assessed at the same time.

## CONCLUSION

The following conclusions can be drawn from the study:

- The prevalence of ECC in children between 2 and 6 years of age in rural school children was 34.7% and 45.5% in urban school children in Jaipur, India.
- Feeding habits of the child and ECC had a strong correlation which depended on feeding, duration, and frequency of the food.
- A strong association was found between dietary habits of the child and prevalence of ECC. The child having mid meal snacking and the habit of eating sweets was most affected with ECC.
- Oral hygiene practices of the child and prevalence of ECC are closely related with the caries prevalence being less in children who perform oral hygiene practices under parental supervision.

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