Original Research Article

A study to assess the association between early childhood caries and relationship of *Streptococcus mutans* in saliva of mother, child and sibling pairs

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ABSTRACT

Background: Early childhood caries (ECC) is a specific form of rampant caries that initially affects the primary maxillary anterior teeth of infants and children. According to American Academy of Pediatric Dentistry (AAPD) 2011, early childhood caries is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth in a child under the age of six. The objective of this study was to assess the association between early childhood caries and relationship of *Streptococcus mutans* in saliva of mother, child and sibling pairs.

Methods: Group 1 consists of fifty children with early childhood caries along with their mothers and siblings with the child age between 15 months to 5 years and sibling's age between 4 years to 10 years, whereas group 2 consists of fifty caries free children along with their mothers and siblings. For both groups, saliva samples were taken from the child, mother and sibling pairs to estimate the *Streptococcus mutans* count and to determine pH of saliva in these children. DMFT scores, debris scores checked for child, mother and sibling pairs.

Results: *Streptococcus mutans* count was significantly high in group 1 than that of the group 2. Mothers were more correlated to the children in the acquisition of *Streptococcus mutans* than the siblings. Increased no. of meals of the child, pacifier use, low socio-economic status and low maternal education showed significant high correlation with caries prevalence. Low pH score was also significantly correlated with the increase in caries rate.

Conclusions: Maternal factors such as high DMFT scores, low education levels, prolonged bottle-feeding with sweetened milk, pacifier use are strong risk indicators for identifying high caries-susceptible children.

Keywords: ECC, Maternal risk factors, pH of saliva

INTRODUCTION

Health is the level of functional or metabolic efficiency of a living organism. In humans, it is the general

condition of a person's mind and body, usually meaning to be free from illness, injury or pain. Childhood is the age span ranging from birth to adolescence which implies a varying range of years in human development.

Childhood is an important stage in child's life and the early childhood caries is the most common disease of this phase. This is often accompanied by serious morbidities affecting children, their families and the health care system.¹

Early childhood caries (ECC) is a specific form of rampant caries that initially affects the primary maxillary anterior teeth of infants and children.² According to American academy of pediatric dentistry (AAPD) 2011, early childhood caries is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth in a child under the age of six.³ This is an infectious disease where various other factors like diet, feeding habits, oral hygiene maintenance and oral micro flora also play a very important role. Among microbiological factors, *Streptococcus mutans* are considered to be the main culprit for initiation of dental caries in a child. So, early acquisition of *Streptococcus mutans* is an important factor in appearance of ECC in children at an early age. The family members like the mother and sibling also influence in transmission of *Streptococcus mutans* during childhood due to postnatal contact during the window of infectivity.² In addition, characteristics related to mother and sibling, such as high *Streptococcus mutans* levels, high caries experience, poor oral hygiene, cariogenic diet, food eating pattern, low socio-economic status, and low education levels could be the risk indicators of caries for their children.^{2,3}

Dental caries in pre-school children remains a significant public health problem in various parts of the world. Linear correlations between the caries prevalence and mutans group streptococcal counts, the explanatory values are between 3 and 11 %.⁴ Even in India, early childhood caries with prevalence rate of 44% has been reported, which is very alarming and so far, very few prevalence studies have been done in India.⁵

So, there is a need to establish definite relationship between maternal child characteristics and appearance of early childhood caries. So here with authors have carried out this study to investigate the association of maternal, child and sibling characteristics as a factor in early childhood caries and the *Streptococcus mutans* count.

The objective of this study was to assess the association between early childhood caries and relationship of *Streptococcus mutans* in saliva of mother, child and sibling pairs.

METHODS

Fifty children with early childhood caries and fifty caries free children along with their mothers and siblings with the child age between 15 months to 5 years, and sibling age between 4 to 10 years were selected from the outpatient department of P. M. N. M. Dental College,

Bagalkot. The selected subjects were free from all medical problems.

These children were divided in two groups-group 1 or the study group consists of fifty children with early childhood caries along with their mothers and siblings with the child age between 15 months to 5 years and sibling's age between 4 years to 10 years, whereas group 2 or control group consists of fifty caries free children along with their mothers and siblings. For both the groups, saliva samples were taken from the child, mother and sibling pairs to estimate the *Streptococcus mutans* count and to determine pH of saliva in these children. DMFT scores were recorded using World Health Organization criteria, 1983 and debris scores using Green and Vermillion index, 1964 for child, mother and sibling pairs.

The questionnaire for the mother was conducted where the mother was interviewed regarding the socioeconomic status, brushing habits, food patterns, and feeding habits of the children.

Dental examination

The dental examination of children, their mothers and siblings were done. The mother's and sibling's caries status were recorded according to the world health organization criteria, 1983. The child's caries status was recorded as dfs scores according to World health organization criteria, 1985 based on the presence of one or more primary teeth affected. Debris scores of mother-child and sibling pairs were evaluated using the green and vermilion simplified debris index, 1964. The mothers' caries status was recorded according to World health organization criteria.⁶

For ECC diagnosis, the national institute of dental and craniofacial research's (NIDCR) definition was used, which was based on the presence of 1 or more primary teeth affected.⁷ White spot decalcifications were not considered to be caries, and loss of mineral substance with cavitation was recorded as caries. Before dental examination of the children, wet sterile gauze pads were used to clean all the teeth surfaces. The dental examination was performed using a visual and non-tactile technique ("lift the lip") without probing.

Plaque scores of mother-child pairs were evaluated using the criteria of Silness and Loe, 1964:⁸

0=no plaque

1=a film of plaque adhering to the tooth's free gingival margin and adjacent area

2=moderate accumulation of soft deposits within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye

3=abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

The plaque indices were calculated by summing the scores for all teeth surfaces and dividing by the number of surfaces.

Bacterial examination

Whole non-stimulated saliva samples were obtained from each child, mother and sibling for isolation of *Streptococcus mutans*. These salivary samples were transported to the laboratory in 1ml of buffered saline and processed within 2 hours.² The samples were sonicated for 20-30 seconds for homogenization and diluted with buffered saline. Samples were then plated on Mitis Salivarius (MS) agar. The agar plates were incubated at aerobically at 37°C for 48 hours.

From each of the dilutions, 0.1ml samples were plated on Mitis-Salivarius (MS) agar (Difco, Detroit, Mich) with 15% sucrose (Difco, Detroit, Mich) and 0.2 units/ml of bacitracin (Sigma, Sigma-Aldrich Co, St. Louis, Mo), prepared according to Gold et al.⁹ The agar plates were then incubated at 37°C in a 5% CO₂ atmosphere for 48 hours. The numbers of *S. mutans* were identified by colony morphology under magnification of 100x using light microscopy and colony forming units were identified under magnification of 40x. The pH of saliva in child was determined using digital pH meter.

RESULTS

Salivary *Streptococcus mutans* count of both group 1 (Study group) and group 2 (Control group) were compared using t test and there was statistically significant difference among the groups.

Among the patients the mean *S. mutans* count was 4.84 in the study group and 1.48 in the control group with Standard Deviation of 0.82 and 0.50 respectively. The difference in the *S. mutans* count among the patients was found to be statistically significant (Table 1).

Table 1: Comparison of study and control groups with respect to log *S. mutans* counts in patients by t-test.

Groups	N	Mean	SD	t-value	P-value
Study group	50	4.84	0.82	24.7373	0.00001*
Control group	50	1.48	0.50		

*Statistically significant

Among the mothers of the patients the *Streptococcus mutans* count was also estimated and found to be with mean value of 3.84 in the study group and 2.02 in the control group with standard deviation of 0.82 and 0.68 respectively in both the groups.

The difference in the *S. mutans* count among the patient's mothers was found to be statistically significant (Table 2).

Table 2: Comparison of study and control groups with respect to log *S. mutans* counts in mothers by t-test.

Groups	N	Mean	SD	t-value	P-value
Study group	50	3.84	0.82	12.0705	0.00001*
Control group	50	2.02	0.68		

*Statistically significant

Among the siblings of the cases the *Streptococcus mutans* count was also estimated and found to be with mean value of 3.58 in the study group and 1.7 in the control group with Standard deviation of 0.84 and 0.46 respectively in both the groups. The difference in the *S. mutans* count among the patient's siblings was found to be statistically significant (Table 3).

Table 3: Comparison of study and control groups with respect to log *S. mutans* counts in siblings by t-test.

Groups	N	Mean	SD	t-value	P-value
Study group	50	3.58	0.84	13.9214	0.00001*
Control group	50	1.70	0.46		

*Statistically significant

Early childhood caries was compared with the mother characteristics, socioeconomic criteria, food patterns and feeding habits of children. There was less significant correlation between the maternal education and early childhood caries with p value of 0.00001. Socio-economic criteria were compared with early childhood caries and there was less significant correlation with p value of 0.00001. Number of meals and early childhood caries were compared and there was statistically high significant correlation with p value of 0.00001. Pacifier use and early childhood caries was compared and there was a significant correlation with p value of 0.1541 (Figure 1).

Figure 1: Correlation between early childhood caries with the mother characteristics, socioeconomic criteria, food patterns and feeding habits of children.

The pH of saliva and early childhood caries of group 1 (study group) children was compared and correlation was found to be negative but statistically significant (Table 4).

Table 4: Correlation between pH of saliva and ECC in 15 months to 5-year-old children.

Variables	Correlation between pH of saliva with		
	R-value	t-value	p-value
Early childhood caries	-0.8374	-10.6163	0.00001*

*Statistically significant

DISCUSSION

ECC is a form of early, moderate and late dental decay that affects the primary teeth of infants and toddlers. It develops in tooth surfaces that are usually at low risk for caries, such as the labial surfaces of maxillary incisors and lingual and buccal surfaces of maxillary and mandibular molars.

ECC always begins with an early stage; starting with white or brown spots, appearing at the gum line. In the moderate stage, cavitation starts, and caries begins to spread to the maxillary molars. In the severe stage, the caries process destroys the maxillary teeth, and spreads to the mandibular molars. Finally, in very severe cases the mandibular incisors are affected.¹⁰

In present study, authors got statistically significant high *Streptococcus mutans* count in group 1 (children with early childhood caries, their mothers and siblings) than that of group 2 (caries free children, their mothers and siblings) with the P value of 0.00001. This is in accordance with the study done by Nazan Kocatas Ersin, Nesrin Eronat in 2006, where the salivary *Streptococcus mutans* was detected in 49% of the children.² This could also be co related with the study done by Radford JR and Ballantyne HM, 2000 where they stated that in younger age group, salivary *Streptococcus mutans* were isolated significantly more frequently from those with caries compared those who were caries free.¹¹ Also authors found statistically significant high levels of salivary *Streptococcus mutans* count in the mothers as well as sibling pairs of group 1 children (children with early childhood caries) than that of the group 2 (caries free children) and children showed increased co relation with the mothers more than that of the siblings. This could be correlated with the study done by Gronroos et al, who have found the maternal transmission of MS in 64% of her culture-positive children and study done by Li and Caufield et al, who have also found identical genotypes of MS in approximately 71% of 34 mother-infant pairs.^{12,13} Even it could be co related with the study done by Thorild B et al, Lindau Jonson et al, where 50% of mothers exhibited high colonization levels and there was a positive co relation between oral levels of *Streptococcus mutans* in mother-child pairs.¹⁴ But this is

in contrast with the study done by Vachirarojpisan T et al, Shinada K et al, who found that there was no correlation between children and mothers' mutans streptococci in their study.¹⁵ Also in present study authors have found a positive significant co-relation between DMFT scores of the children, mothers, sibling pairs and the *Streptococcus mutans* level in them. Higher the DMFT score, more the level of *Streptococcus mutans* count. This study was in accordance with study done by Seval Olmez, Meryem et al, where the establishment of MS is associated with caries initiation in early childhood.¹⁶ More the carious lesions, higher the level of *Streptococcus mutans* colonization was observed in the groups. This could also be correlated with the study done by Milgrom P and Weinstein P where children with a high level of *S. mutans* detected were 5 times more likely to have dental caries than children with a lower level of *Streptococcus mutans*.¹⁷

Statistically significant correlation was found between maternal education and early childhood caries (as shown in Figure 1). This was in accordance with the study done by Nazan Kocatas Ersin, Nesrin Eronat, where it was reported that the minimal maternal education might have an impact on the distribution of ECC.² Even there was significant correlation between the socio-economic status of the family and the early childhood caries. This could be co related with the study done by Seval Olmez, Meyrem, where the percentage of carious lesions found in the population of low socio-economic status was 75.5.¹⁶

However, authors found very less significant correlation between the duration of breast feeding and the early childhood caries. This could be co related with the studies done by Nazan Kocatas Ersin, Nesrin Eronat where the mean duration of breast feeding was 12 months, and more than half the children had been breast-fed more than a year, but the prolonged demand breast feeding didn't lead to a higher caries prevalence in their study.² There was significant correlation between the use of pacifier and the early childhood caries. This could be co related with the study done by Nazan Kocatas Ersin, Nesrin Eronat, 2006 where there was a positive correlation between the duration of using pacifier and caries in them.² There was also significant correlation between the number of the meals of the child, and early childhood caries. This could be co related with the study done by Milgrom P, Riedy CA who found that frequent snacking in between the meals and increased number of meals led to increase in the caries prevalence.¹⁷ Authors have also examined the oral hygiene status of the children and compared it with the early childhood caries. There was highly significant correlation between the low pH of saliva, poor oral hygiene and the caries risk assessment in the children. This was in accordance with the study done by Nazan Kocatas Ersin, Nesrin Eronat, where the correlation between ECC and plaque scores was found to be statistically significant. Children having a plaque score of 1 had a dfs level of 0.1 (± 0.6), and children with plaque

scores of 2 and 3 had dfs levels of 1.1 (± 3.4) and 3.8 (± 4.2), respectively.

CONCLUSION

Maternal factors-such as high DMFS scores, low education levels, prolonged bottle-feeding with sweetened milk, pacifier use, and maternal sharing are the strong risk indicators for identifying high caries-susceptible children. High levels of *Streptococcus mutans* count were found in the children with the early childhood caries than that of the caries free children. Children showed more correlation with mothers in the acquisition of *Streptococcus mutans* than that of the siblings indicating that mothers are the principal source of mutant's streptococci in them. Prolonged breast feeding did not much co-relate with the early childhood caries. The children who were having the older siblings, showed increase in the caries rate than that of children having the younger ones. Considering the maternal risk indicators, antibacterial measures should be taken so as to reduce the number of caries-related microorganisms in children and it should also be applied to mothers who have high DMFS scores in order to prevent caries progression in their children.

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