

## An analytical Study about the Streptococcus Mutans Load in the Pre School-Children of Local Schools

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Received: 26-10-2022 / Revised: 30-11-2022 / Accepted: 20-12-2022

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Conflict of interest: Nil

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### Abstract

**Introduction:** More than one third of children in the lower socio-economic group belonging to 2-9 years have untreated decayed primary teeth. Several studies have shown a direct relationship between dental caries and *Streptococcus mutans*. In this study, we report the comparative load / magnitude of *Streptococcus mutans* between preschool children attending local public and private schools.

**Methods:** Samples of 200 subjects were taken. Children suffering from any previous Oral Pathology were excluded. Saliva sample was collected from the children with verbal consent from the school authorities on clarifying the sampling process being non-invasive and the data not used for commercial purposes nor any personal identifier collected except the age of the subject.

**Result:** Among all the school children screened in this study, 39.5% were found to carry *S. mutans* in their oral cavity based on the bacterial recovery from saliva. Children attending the private school had relatively low incidence of *S. mutans* in their saliva compared to those attending the Govt /public school. 51% of children had saliva with low pH, 35% at normal pH range and 14% of the children had saliva with basic pH. The children with low pH saliva had caries in their tooth. All *S. mutans* saliva isolates were found to be sensitive to the antibiotics tested viz. penicillin, amoxicillin, erythromycin and vancomycin.

**Conclusion:** The oral health is crucial for pre-school children at the age of 2-7. Instituting suitable preventive measures such as awareness campaign on oral hygiene, dietary regulation and periodic medical screening can control the level of cariogenic ability of microorganisms and in turn ensure their dental wellbeing.

**Keywords:** Caries, Streptococcal Mutans, Pre-School Children, Saliva, pH

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### Introduction

Dental caries is a global pandemic disease that can be serious and may even be life-

threatening. It is a unique multifactorial infectious disease [1]. Dental caries is a

localized infection that can lead to the destruction of hard dental tissue. Often, the causal organism may undergo horizontal transfer in the community making this a public health burden [1]. Socio-economic disparities in the community often play a critical predisposing role in children with poor being more vulnerable to dental caries due to malnourishment and deficient oral hygiene practices [1,2]. More than one third of children in the lower socio-economic group belonging to 2-9 years have untreated decayed primary teeth [2,3]. Among many oral microbial pathogens, several studies have shown a direct relationship between dental caries and *Streptococcus mutans*.

Even though saliva is an important component of digestive and innate immune system, it also provides nutrition for the causal organisms of dental caries. Decayed tooth is an important source of dental caries causal pathogen. *Streptococcus mutans* is one of the major oral bacterium commonly found in decayed tooth. Among the genus streptococcus, *Streptococcus mutans* is the first mutans streptococci to colonize infants shortly after their first tooth erupt and was the only mutans streptococci found to be isolated from caries in infants [4].

It is possible to have cavity-free child, provided appropriate preventive measures are applied in time. Among the general population, children belonging to 2-5 years of age are of special interest as controlling the level of *Streptococcus mutans* in them are often reported beneficial to protect the upcoming dentition from the cariogenic ability of these organisms. Constant change in population structure in a community warrants continued monitoring of etiological agents of diseases that have public health importance. In this study, we report the comparative load / magnitude of *Streptococcus mutans* between preschool children attending local public and private schools.

## Methodology

This study includes an analysis on the magnitude / load of *Streptococcus mutans* among pre-school children attending local Private Schools and Government Schools / Anganwadis selected Randomly. The study was conducted within ethical standards. Randomization was done using computer tables in selecting data. For the purpose of the present study, data of 200 of the randomly selected patients (candidates / study subjects) was taken. Children suffering from any previous Oral Pathology were excluded.

## Sample

Saliva sample was collected from the children with verbal consent from the school authorities on clarifying the sampling process being non-invasive and the data not used for commercial purposes nor any personal identifier collected except the age of the subject. The saliva samples were collected from the children between 9.00 am – 11.00 am before lunch (after breakfast) to limit food ingestion and control this variable that can alter the salivary physiochemical properties as well as microbial load.

## Salivary flow rate and pH

The secretion of whole mixed saliva was measured. After collecting, it was transferred to the laboratory in a refrigerated condition. Amount of saliva secreted from each child was quantified. Children with dental caries had a tendency of low amounts of saliva than the children without caries. After using the saliva sample for bacterial isolation, the pH was measured and recorded.

## *Streptococcus mutans* isolation

*S. mutans* from the saliva samples was isolated using mutans specific Mitis Salivarius Bacitracin Agar [5] Using a sterile cotton swab, the sample was inoculated on the selective agar and the plates were incubated at 37°C in a candle jar for 48 hours.

*S. mutans* was further characterized using standard morphological and biochemical tests [6]. Antibiotic sensitivity of the *S. mutans* isolated from the saliva samples for penicillin, erythromycin, amoxicillin, bacitracin and vancomycin was tested using standard disc diffusion technique [7].

Data was filled in Microsoft Excel & continuous data were expressed as mean  $\pm$  standard deviation (SD). The data were

analyzed by IBM SPSS Statistics 23. Overall,  $p < 0.05$  was proposed to represent statistical significance after correction.

### Results

This study screened pre-school children for the prevalence of *Streptococcus mutans* and its relationship with caries, salivary buffering capacity, and salivary flow rate. Antibiotic sensitivity pattern of the isolates were also determined.

**Table 1: Incidence of *Streptococcus mutans* in the pre-school children saliva**

S. No.	School	No. of sample tested	<i>S. mutans</i> Positive	Percentage
1.	Public/Govt schools	100	58	58%
2.	Private schools	100	21	21%
Total		200	79	39.5%

Among all the school children screened in this study, 79/200 (39.5%) were found to carry *S. mutans* in their oral cavity based on the bacterial recovery from saliva (Table 1). Children attending the private school had relatively low incidence of *S. mutans* (21/100; 21%) in their saliva compared to those attending the Govt /public school (58/100; 58%). When the saliva samples were tested for their pH status, 51% of children had saliva with low pH, 35% at normal pH range and 14% of the children had saliva with basic pH. The children with low pH saliva had caries in their tooth. All *S. mutans* saliva isolates were found to be sensitive to the antibiotics tested viz. penicillin, amoxicillin, erythromycin and vancomycin (Table 2)

**Table 2**

S. No.	Type of school	No. of <i>S. mutans</i>	Antibiotics sensitivity			
			Erythromycin	Amoxycillin	Penicillin	Vancomycin
1	Public school	34	Sensitive	Sensitive	Sensitive	Sensitive
2	Private school	9	Sensitive	Sensitive	Sensitive	Sensitive
Total		43	100%	100%	100%	100%

### Discussion

Pre-school children (n=200) attending public and private school were screened for the presence *S. mutans* the known causal organism for dental caries. The age group of the children sampled in this study was 3-6 years. As anticipated, higher incidence of the bacterium was recorded in children from the Govt / Anganwadi / public school compared to private school. In India, economic

affluence influences the students' choice of school system. Low income people most often cannot afford to enroll their children in private schools and hence forced to select the public schools run by the Municipal Corporation and local government bodies / Anganwadis. Poor children are the most vulnerable group of people for early childhood caries (ECC) especially in

developing countries such as India [8] Gamboa *et al.* reported similar *S.mutans* prevalence profile in school children [9]. They have reported that 62% of children sampled had come out positive for *S.mutans*.

One of the major predisposing factors for dental caries is the presence of acidogenic bacteria in the oral niche. In this study, 51% of the children had saliva with low pH accompanied by dental caries. This seems to have been complicated by low saliva flow rate and quantity compared to non-caries children. Higher incidence of *S. mutans* in this population is not surprising especially when corroborate with the salivary pH. Baker *et al.* (2016) in their exhaustive review article have summarized the uncanny abilities of *S. mutans*'s ability to survive, proliferate and colonize in acidic environment & similar findings were in other studies [2,10-14].

One comforting data in the present study is the antibiotic sensitivity profile of the saliva *S. mutans* isolates. All the *S. mutans* isolates were sensitive to most commonly used antibiotics such as penicillin, erythromycin, and amoxicillin. Similar observation was reported by Gamboa *et al.* which make it relatively simple to treat the infection and interrupt the possible transmission across the population and inturn the disease burden and clinical sequel [9].

### Conclusion

The oral health is crucial for pre-school children at the age of 2-7. Instituting suitable preventive measures such as awareness campaign on oral hygiene, dietary regulation and periodic medical screening can control the level of cariogenic ability of microorganisms and in turn ensure their dental wellbeing.

### Acknowledgements

We would like to thank all the participants of the study, Principals, Teachers, Anganwadi workers who helped us.

### References

1. Azevedo, TD, Bezerra, AC, de Toledo,OA. Feeding habits and severe early childhood caries in Brazilian preschool children. *Pediatr Dent.* 2005 Jan-Feb; 27(1):28-33.
2. Baker, JL, Faustoferri, RC and Quivey, RG, Acid-adaptive mechanisms of *Streptococcus mutans*—the more we know, the more we don't. *Mol oral Microbiol.* 2016.
3. de Silva-Sanigorski AM, Calache H, Gussy M, Dashper S, Gibson J, Waters E. The Vic Generation study--a birth cohort to examine the environmental, behavioural and biological predictors of early childhood caries: background, aims and methods. *BMC Public Health.* 2010 Feb 25; 10-97.
4. Costalonga, M and Mark C. Herzberg. The oral microbiome and the immunobiology of periodontal disease and caries. *Immunology Letters.* 2014; 162(2):22-38.
5. Gold,OG., H.V. Jordan, and J. van Houte. A selective medium for *Streptococcus mutans*. *Arch. Oral Biol.* 1973; 18(11): 1357-1364.
6. <https://www.cdc.gov/streplab/strep-doc/general-methods-section2.html> Accessed on 03/06/2022
7. Bauer, A W D, Perry, M and Kirby WMM. Single disc antibiotic sensitivity testing of *Staphylococci*. *A.M.A. Arch. Intern. Med.* 1959; 104:208–216.
8. McDonald RE, Avery DR. *Dentistry for the child and adolescent.* 8th ed. Philadelphia (PA): Mosby; 2004; 209.
9. Gamboa, F., Estupinan, M. and Galindo, A. Presence of *Streptococcus mutans* in saliva and its relationship with dental caries. *Antimicrobial susceptibility of the isolate. Microbial Oral Ecol.* 2004; 9: 23 – 27.
10. Berkowitz, RJ, and Jones, P. Mouth-to-mouth transmission of the bacterium

- Streptococcus mutans between mother and child. Arch Oral Biol. 1985; 30(4):377-9.
11. Davey AL, Rogers, AH. Multiple types of the bacterium Streptococcus mutans in the human mouth and their intra-family transmission. Arch Oral Biol. 1984; 29(6):453-60.
  12. Dye, B, Thornton-Evans G, Li X *et al.* Dental caries and sealant prevalence in children and adolescents in the United States, 2011–2012. NCHS Data Brief 2015; 191: 1–8.
  13. Hildebrandt, G.H. and Bretz W.A. Comparison of culture media and chair side assays for enumerating mutans streptococci. J. Appl. Microbiol 2006; 100: 1339 – 1347.
  14. Vargas CM, Ronzio CR., Disparities in early childhood caries. BMC Oral Health. 2006 Jun 15; 6(1):S3.