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Socio-economic and Susceptibility Study of Dental Caries in Different Age Group People at Allahabad, India

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Abstract

Dental caries is one of the most common infectious diseases in the human oral cavity. In developing countries like India, the rate of dental caries is rising because more than 80% of the world's children live in these countries; dental caries disease is considered to be a major public health problem. In this study total 180 saliva samples were collected from different age group, socioeconomic status, sex as well as different brushing schedule of peoples from Allahabad. On the basis of different age group peoples, the most susceptible (83.3%) was significantly higher age group 11-20 years followed by age group of >51 (73.3%), <10 (66.6%), 21-30 (63.3%), 41-50 (63.3%) and the lowest susceptible (53.3%) was noticed in age group of 31-40. Significantly higher dental caries susceptibility (86.66%) was noticed in lower class followed by Higher class (68.33%) where as the least with only 46.66% affected people was noticed in middle class. The significantly higher susceptibility to dental caries was seen 61.98% in male as compared to female 38.02%. The higher susceptibility to dental caries 78.57% in patient who brushed their teeth once in day, followed by whose brushed their teeth twice in day (63.46%), the minimum (36.66%) observed in patient who's brushed their teeth thrice in day. Therefore, a need exists to identify individuals at risk for the disease, and to target preventive measures and active treatment for these individuals.

Introduction

Streptococcus mutans is an important component of the biofilms on teeth (dental plaque) associated with many forms of dental caries. Estimation of the salivary levels of this organism may be useful for assessing caries risk in patients and for monitoring their response to preventive measures (1). *Steptococcus mutans* adheres firmly to the smooth tooth surfaces and produces sticky water insoluble dextran from dietary sucrose, forming plaque, which facilitates the accumulation of microorganisms. *Streptococcus mutans* and other organisms in the plaque produce organic acids such as lactic acid that gradually destroy the enamel and form a cavity (2).

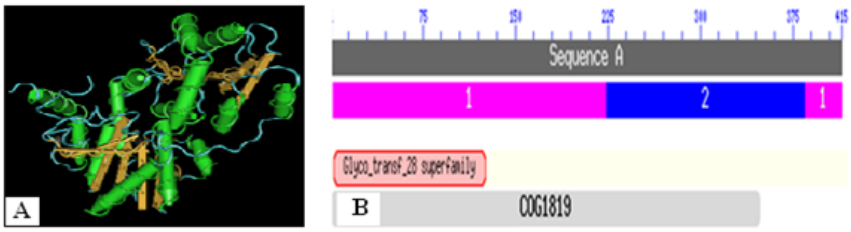
The caries-inducing properties of *S.mutans* depend on its adhesion ability (3), and also of its acid-producing and glucan synthesis activities. Bacterial adhesion or attachment to the tooth surface involves specific molecular interactions between complementary molecules on the microbial and host surface, which require the participation of two factors; a receptor and adhesion. Hydrophobic forces or cell surface hydrophobicity also play an important role in the initial adhesion of bacteria to tooth surfaces (4). Among the oral streptococci, *S. mutans* has a higher degree of surface hydrophobicity (5), and its adhesion to saliva-coated hydroxyapatite depends on hydrophobic interaction (6).

S.mutans produces glycosyltransferase (GTF), which allows the production of soluble and insoluble glucan. Glycosyltransferase from *S. mutans* is the most significant virulent factor in dental caries, where sucrose plays an important role as a natural source of energy and it is converted to long chain polysaccharides (7).

Taxonomical information of bacteria is: Bacteria; Firmicutes; Lactobacillales; Steptococcaceae; *Steptococcus*. GtfB gene is basically responsible for production of 'glucosyltransferase-I'. Firmicutes basically involve Bacillales, Clostridia, Lactobacillales, and Mollicutes.

A crystal structure of Udp-Glucosyltransferase GtfB can be collected from MMID 16966 and PDB ID 1IIR. Glucosyltransferase has two domain structures (8).

Figure 1. A: 3D structure of glucosyltransferase gene B: Domain information of glucosyltransferase superfamily



Saliva is an oral fluid which screated by salivary gland (9). Generally consist of desquamated epithelial cells, bacteria, leucocytes, food residues, blood and viruses. Important function of saliva can be attributed such as maintenance of healthy oral tissues; protects against irritation by coats on mucosa; tooth remineralization and antimicrobial action. Usaually the bacterial content of saliva is arround 109 bacteria per ml (10, 11).

Materials and Methods

Experimental site and duration of study

This study was conducted in Biological Product Laboratory, Department of Botany, University of Allahabad, during the period extending from August 2005 to May 2008.

Study group

These samples were judged on the basis of patients brushing their teeth, economic status, sex and age groups.

Site of collection

180 samples were collected from different Dental hospitals, Clinics, Schools and Colleges located at Allahabad city (North central part of India) (Fig. 2). These include.

- Saumya Dental Clinic Taigore Town, Allahabad.
- Sangam Dental Clinic Allahapur, Allahabad.
- Naseem Dental Care Rajapur, Allahabad.
- Kendriya Vidyalaya Naini, Allahabad

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- YMCA School, Allahabad
- Pragasi Prathamic Vidyalaya Rajapur, Allahabad.
- International Academy Naini, Allahabad.
- Dev Prayag Phaphamau, Allahabad.

Sample collection

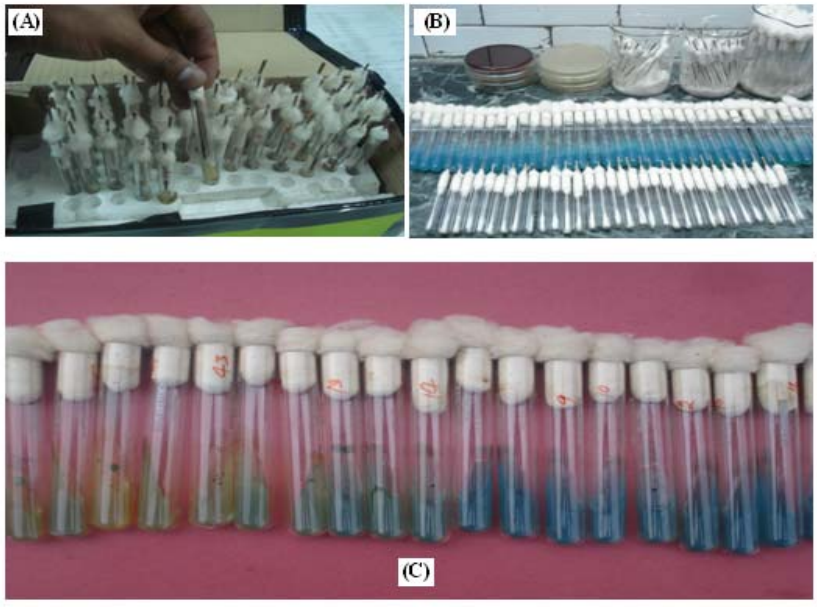
Saliva was collected from decayed tooth portions in sterilized test tube with the help of sterilized cotton swabs and then swabs were streaked aseptically on synder agar slant for determination of caries susceptibility test (Fig. 2). One uninoculated tube serves as a control at 37ºC for 48 hours (12).

Figure 2. Collection of saliva from school childrens and various age group people at Dental Clinic of Allahabad under the supervision of dental surgeon Dr. Pravin Tiwari

Determination of dental caries susceptibility by Synder agar test

Determination of susceptibility to dental caries was performed by the synder test (12). It is the measurement of the rate of acid production from the metabolism of glucose by *Lactobacilli* and *Streptococci*. This method utilized synder agar (pH=4.7) that contains glucose as the carbohydrate and bromocresol green as the pH indicator. As the *Lactobacilli* present in the saliva grow in the synder agar, they utilize glucose of the medium converting it to organic acids and thereby lowering the pH to 4.4 or lower at which the caries process begins. At this pH, bromocresol green turns yellow. The susceptibility of individual to dental caries is determined by the time it takes for change of colour from green to yellow (Fig. 3). If the medium turns yellow within 24 to 48 hours the individual was said to be susceptible to dental caries.

Figure 3. Dental caries susceptibility on Synder agar slants (A) Collection of Saliva (B) Synder agar slants (C) Dental caries susceptibility on Synder agar slants



Results

180 samples were collected from different Dental hospitals, Clinics, Schools and Colleges located at Allahabad city (North central part of India). Out of 180 saliva samples collected from different age group peoples, 67% were found to be positive on the basis of dental caries susceptibility test. The Statistical analysis of data using x^2 (Chi-square)-test, showed that the most susceptible (83.3%) was found in age group 11-20 years followed by age group of >51 (73.3%), <10 (66.6%), 21-30 (63.3%), 41-50 (63.3%) and the lowest susceptible (53.3%) was noticed in age group of 31-40 (Table 1, Fig. 4).

Table 1. Incidence of dental caries susceptibility by synder agar test on the basis of different age group

Age Group (Years)	No. of saliva sample collected	No. of dental caries susceptibility	% of dental caries susceptibility by synder agar test
<10	30	20	66.6
11-20	30	25	83.3
21-30	30	19	63.3
31-40	30	16	53.3
41-50	30	19	63.3
>51	30	22	73.3
Total	180	121	67

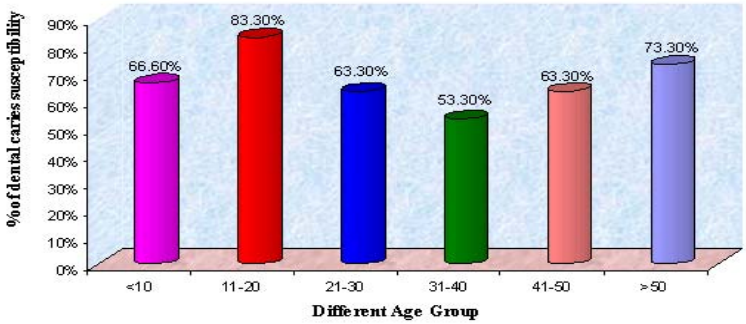
x^2 (Chi-square)-test (5%)

$$x\ 2 = \sum_{i=1}^{n} \frac{(O_i - e_i)^2}{e_i}$$

Where, $\sum$= sum of, O_i = observed value, e_i = estimated value
Table value: 10, Calculated value: 20.9, Result: **Significant**

Since, the calculated value of x^2 was greater than table value at 5% level of significance. So it was concluded that dental caries susceptibility varied with age factor.

Figure 4. Incidence of dental caries susceptibility by synder agar test on the basis of different age group



The collected saliva samples from different socioeconomic status, 67% were found to be positive. The Statistical analysis of data using x^2 (Chi-square)-test showed that the maximum dental caries susceptibility (86.66%) was noticed in lower class socioeconomic people followed by Higher-class socioeconomic status (68.33%). The least proned towords dental caries with only 46.66% affected people was noticed in middle class socioeconomic status (Table 2; Fig. 5).

Table 2. Incidence of dental caries susceptibility on the basis of socioeconomic status

Socioeconomic status	No. of saliva sample collected	No. of dental caries susceptibility	% of dental caries susceptibility
Higher	60	41	68.33
Middle	60	28	46.66
Lower	60	52	86.66
	180	121	67

Since, the calculated value of x^2 was greater than table value of 5% level of significance. So it was concluded that the dental caries susceptibility varied with socioeconomic status.

Out of above mentioned saliva samples collected from different sex group, 67% were found to be positive. The Statistical analysis of data using z - test, showed that the maximum susceptibility to dental caries was found to be 61.98% in male as compared to female which were noticed only 38.02% susceptible cases (Table 3).

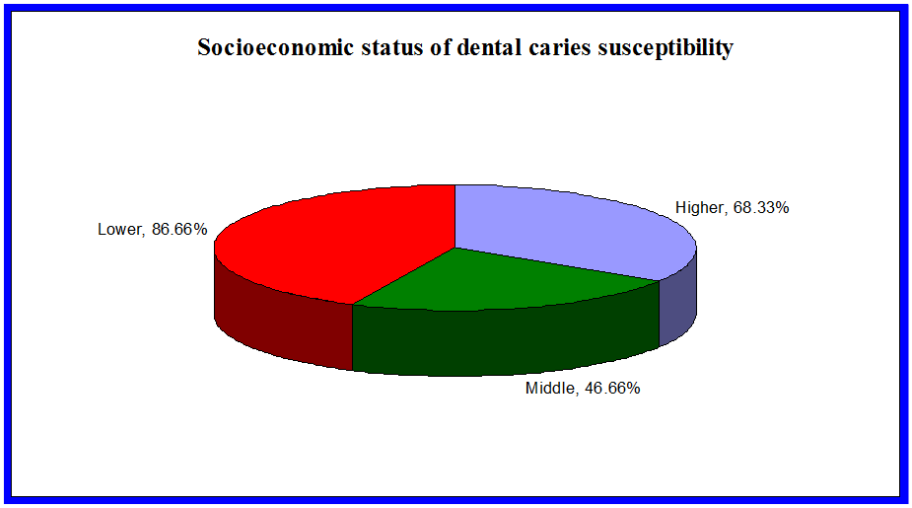


Figure 5. Incidence of dental caries susceptibility on the basis of socioeconomic status

Table 3. Incidence of dental caries susceptibility on the basis of Sex

Sex	No. of saliva sample collected	% of sample collected	No. of dental caries susceptibility	% of dental caries susceptibility
Male	102	56.66	75	61.98
Female	78	43.34	46	38.02
	180	100	121	100

Z-test (5%)

$$Z = \frac{p_1 - p_2}{\sqrt{\frac{p_1 q_1}{N_1}\frac{p_2 q_2}{N_2}}}$$

Where, P_1 = Incidence in 1st group / total no. of case in 1st group, P_2=Incidence in 2nd group / total / total no. of case in 2nd group, q_1=1- p_1, q_2=1- p_2, N_1 = Total no. of cases in 1st group, N_2 = Total no. of cases in 2nd group

Table value: 1.96, Calculated value: 50, Result: **Significant**

Since, the calculated value of Z was greater than table value at 5% level of significance. So, it was concluded that the dental caries susceptibility also depends upon the sex.

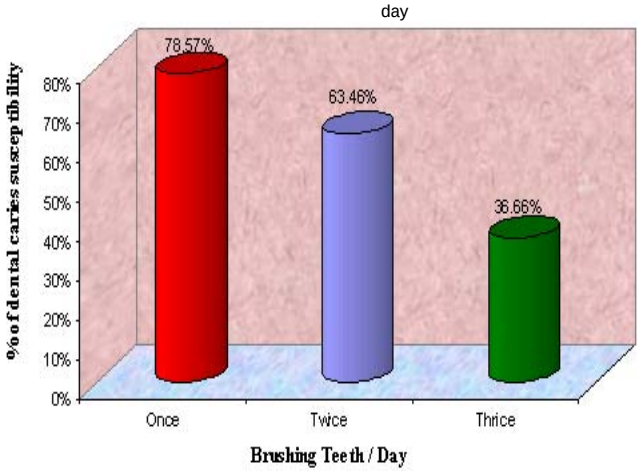
The 67% were found to be positive in case of different brushing schedule**,** The Statistical analysis of data using x^2 (Chi-square)-test, showed that the maximum susceptibility to dental caries was found to be 78.57% in patient whose brushed their teeth once in day, followed by patient whose brushed their teeth twice in day (63.46%), the minimum (36.66%) susceptibility to dental caries was observed in patient whose brushed their teeth thrice in day (Table 4; Fig. 6).

Table 4. Incidence of dental caries on the basis of patient brushing their teeth per day

Brushing teeth /day	Total saliva sample collected	No. of dental caries susceptibility	% of dental caries susceptibility
Once	98	77	78.57
Twice	52	33	63.46
Thrice	30	11	36.66
	180	121	67

Since, the calculated value of x^2 was greater than table value at 5% level of significance. So it was concluded that caries susceptibility shows dependency on sheudule of brushing.

Figure 6. Incidence of dental caries on the basis of patient brushing their teeth per day



In the present study, total 180 saliva samples were collected from different age group, socioeconomic status, sex as well as different brushing schedule of peoples.

From different age group peoples, 67% were found to be positive dental caries susceptibility on the basis of Synder agar test. Ali *et al.*, (13) was also using similar type of study for caries suspectibility, the high frequency of caries causing bacteria (83.3%) in the saliva of children 11 to 22 years aged. However, Grábris *et al.*, (14) have also reported a high prevalence of *Streptococcus mutans* in adolescents aged 14 to 16 years. Roters *et al.*, (15) reported that at 2 years of age, teeth up to the deciduous molars have erupted in most children and subsequent changes in development did have no major effects on the oral microbiota.

According to Rogers *et al.*, (15), this factor may reflect changes in the oral microbial population. Children in the age ranges of below 10 years and 10 to 20 years presented this species. Edwardson *et al.,* (16) detected *Streptococcus sanguis*, *Streptococcus mutans* and *Streptococcus salivarius* in the saliva of children aged 9 to 11 years old observing that this last specie corresponded to 34% of the total

Streptococci count. Children aged 11 to 20 years show that in the present study *Streptococcus mutans* also presented a higher frequency in the same age range, corresponding to 83.30% by the standard method.

Grindefjord *et al.*, (17), in Sweden, observed that of 692 saliva samples from children aged 1 to 2.5 years showed *Streptococcus mutans* and 21% carried lactobacilli, differing of the 116 samples containing *Streptococcus mutans* observed in the present study among a total of 262 saliva samples analyzed (29.51%). These differences in colonization by *Streptococcus mutans* may be due to the different methods employed and also to the dietary habits and dental anatomy in the populations studied. Recently, the polymerase chain reaction (PCR) has been introduced to identify the mutans streptococci (18), and several techniques may be used together in order to obtain a reliable identification. However, it requires considerable time consuming and may not provide satisfactory reliability (18).

In the present study, maximum dental caries susceptibility (86.66%) was noticed in lower class followed by Higher class (68.33%) where as the least with only 46.66% affected people was noticed in middle class. The significantly higher susceptibility to dental caries was seen 61.98% in male as compared to female 38.02%. The higher susceptibility to dental caries 78.57% in patient who brushed their teeth once in day, followed by whose brushed their teeth twice in day (63.46%), the minimum (36.66%) observed in patient who brushed their teeth thrice in day.

Conclusions

Dental caries may even lead to life threatening infections, and the costs for operative dental treatment are significant for individuals as well as society. The estimation of slaiva and inhancincing its quality is one of the important criteria to avoid dental caries, because not only mutans streptococci provide acidic environment in mouth but occasionally, some other microorganisms are involved in acidogenesis (low pH) in mouth.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the manuscript.

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