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**Research Article**

# Prevalence of Dental Caries among adolescence of Dhanusha District, Nepal

**Yadav K*[1], Prakash S[2], Khanal S[3], Singh JK[4]**

Dept. of Microbiology, Clinical Pathology Laboratory, Janaki Medical College, Janakpur

[1]*Medical Microbiologist & Lecturer, Krishna Medical Technical Research Center, Janakpur
[2]Assistant Professor, Department of Biochemistry, Janaki Medical College, Janakpur
[3]Lecturer, Department of Microbiology, National College, Kathmandu
[4]Assistant Professor, Department of Community Medicine, Janaki Medical College, Janakpur

## ABSTRACT

**Background and Objectives:** In developing countries like Nepal, the oral health system is currently in transition phase facing a high prevalence of dental caries. It has significant social impact in important life activities which hinders the achievement and maintenance of good oral health due to lack of dental awareness in all age groups. *Streptococcus mutans* is the most predominant organism to cause dental caries. Therefore, the present study was designed to determine the prevalence of dental caries and to identify its etiology among adolescence.

**Material and Methods:** This cross-sectional study was carried by following Standard protocols of Bergey's Manual of Systematic Bacteriology to isolate and identify the organism. The data was analyzed using SPPS 17.0 and Microsoft excels 2007 which was considered as statistically significant at p-value < 0.05.

**Results:** The prevalence of dental caries in adolescent was found to be 33%. The highest numbers of patients having dental caries were in the age group of 15-19 in female (66.32%) than male (39.70%). Bacterial growth was observed more in female (75.60%) than male (24.39%) which was found to be statistically significant (p=0.0001). *S. mutans* was found as the most important cause of dental caries. Maxillary region of tooth were more vulnerable to dental caries than mandibular region of tooth. Most of the respondents had once per day brushing habit without fluoridated dentrifice containing tooth paste.

**Conclusion:** The prevalence of dental caries was found one third of total. *S.mutans* was the main causes of dental caries and molars tooth are more affected than others.

**Key Words:** Dental caries, Prevalence, *S. mutans*, Significant, Maxillary, Molar teeth

## INTRODUCTION

The distribution and severity of dental caries vary in different parts of the world and within the same country or region. Nepal is a developing country with little awareness and practice regarding oral health among Nepalese population and has a high morbidity of dental

caries in all age groups of both genders. The prevalence pattern of dental caries varies with age, sex, socio economic status, race, geographical location, food habits and oral hygiene practices [1]. Dental caries, a chronic disease refers to the localized destruction of susceptible dental hard tissues by acidic by-products from the bacterial fermentation of dietary carbohydrates such as sucrose, fructose and glucose which is reversible in its early stages and is recognized as the primary cause of oral pain and tooth loss [2].

In addition, dental caries also results from an ecological imbalance in the equilibrium between tooth minerals and oral biofilms which is also commonly known as plaque [3, 4]. The biofilm is characterized by microbial activity, resulting in fluctuations in plaque $p^H$ which is the result of both bacterial acid production and buffering action from saliva and the surrounding tooth structure. As the $p^H$ falls below a critical value, the demineralisation of enamel, dentine or cementum occurs, while a gain of mineral (remineralisation) occurs as the $p^H$ increases [4,5]. The process of demineralisation and remineralisation takes place frequently during the day. Over time, this process leads to either caries lesions or the repair and reversal of a lesion [6].

The microbial community of dental caries is diverse and contains many facultatively and obligately anaerobic bacteria belonging to the genera *Actinomyces*, *Bifidobacterium*, *Eubacterium*, *Lactobacillus*, *Parvimonas,* Propionibacterium*, *Enterococcus*, *Scardovia, Rothia* and the members of the mitis, anginosus and salivarius groups of streptococci [1, 7]. The experience of pain, problem with eating, chewing, discolored or damaged teeth, smiling and communication due to missing teeth have a major impact on people's daily lives and well-beings [8].

Worldwide, approximately 2.43 billion people (36% of the population) have dental caries in their permanent teeth. In baby teeth it affects about 620 million people or 9% of the population [9]. The higher prevalence of dental caries is influenced by the lack of dental awareness and practice in developing countries as compared to developed countries due to geo-socio-political, economic factors and inadequate health care assets [1, 10, 11]. It has also been associated with low self-esteem, adverse pregnancy outcomes, increased risk of myocardial infarction, cardiovascular, respiratory, erectile, diabetes complications, cavernous sinus thrombosis and Ludwig angina which can be life-threatening [12-14].

Although some studies on the prevalence of dental caries has been studied in Nepal especially in children by Decayed Missed Filling Teeth (DMFT) index, but no any type of research on dental caries has been conducted in adolesence at Dhanusha district of Nepal. Therefore, this study was conducted to determine the prevalence of dental caries and its etiology among adolescence which can provide health care authorities for further planning, implementation and evaluation in public dental health service by spreading awareness of oral hygiene.

## MATERIAL AND METHODS

### Study Design

The present research work was a cross-sectional study which was conducted in the Microbiology laboratory, Department of Clinical Pathology, Janaki Medical College Teaching Hospital (JMCTH), Janakpur, Nepal from April to November, 2014 with the case of 330 clinically ill dental caries patients. All the patients were examined clinically in the dental OPD by Dental Surgeon in the Department of Dentistry.

## Inclusion and Exclusion Criteria

The adolescence patients reported with complaint of teeth cavities associated with or without pain, pus discharge and biofilm deposits or staining in the teeth were included. Caries free dental patients and those having dental caries with age less than 9 years and more than 20 years were also excluded from the study.

## Ethical Consideration

Ethical approval of this study was taken from the Institutional Ethical Committee of National College, Khushibu, Nayabazar, Kathmandu and Department of Microbiology, JMCTH, Janakpur, Nepal. Informed consent was obtained from the participants prior to the study.

## Sample Collection and Processing

A sterile cotton swab was taken and dipped in 1% glucose solution broth. The swab was squeezed on the walls of clean, dry, sterile test tube and pressed gently on the portion of tooth cavity. Then, the swab was rotated 2-3 times and again dipped in the same tube containing glucose solution broth. Immediately, the tube of glucose broth was incubated at 37°C for 3-4 hours. Media were prepared as instructed by the manufacturer company (Hi-media). A loopful of inoculum from glucose broth was streaked on Blood Agar (BA) and Mac Conkey Agar (MA) plates and incubated at 37°C for 24-48 hours. The significant growth of isolates was sub-cultured on Nutrient Agar (NA) and Blood Agar plates which were incubated at 37°C for 24 hours. Identification of significant isolates was done by using Standard microbiological techniques as described in the Bergy's manual which involves morphological appearance of the colonies, Gram's staining reactions and biochemical properties especially carbohydrate fermentation test.

## Statistical Analysis

The data were analyzed using statistical software SPSS 17.0 version and Microsoft excels 2007. The p-value < 0.05 was considered statistically significant.

## RESULTS

### Prevalence of Dental caries among Adolescent

Total of 330 dental caries patients attending dental OPD of JMCTH from April to November 2014, of which 160 were adolescent. The prevalence of dental caries in adolescent was found to be 33%. The results are shown in figure 1.
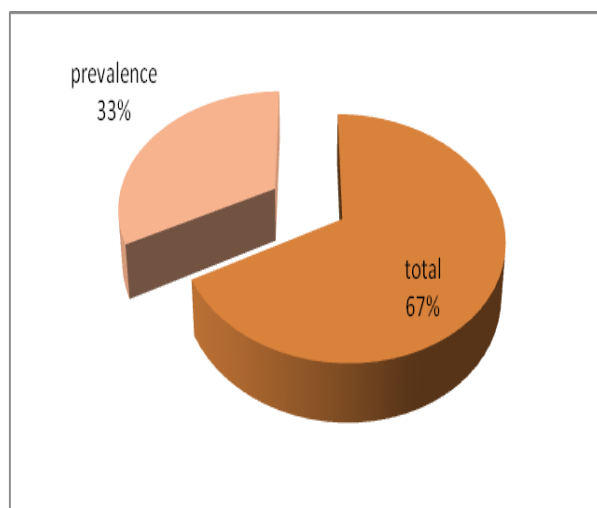


**Figure 1: Prevalence of dental caries among adolescent**

### Age and Gender wise distribution of study population

A total of 160 dental swab samples were collected from adolescence having dental caries. Among them, 62 were male and 98 were female patients. The highest numbers of patients having dental caries were in the age group of 15-19 in female (66.32%) than male (39.70%). The results are shown in table 1.

**Table 1: Age and genderwise distribution of patients**

| Age group (yrs) | Male (%) | Female (%) | Total (%) |
|---|---|---|---|
| 10-14 | 35 (56.45) | 33 (33.67) | 68 (42.5) |
| 15-19 | 27 (39.70) | 65 (66.32) | 92 (57.5) |
| **Total** | **62** | **98** | **160** |

## Gender wise distribution of Bacterial Growth

The highest percentage of bacterial growth was observed in female patients with 75.60% than male (24.39%) which was found to be statistically significant (p=0.0001). The results are shown in table 2.

**Table 2: Pattern of genderwise bacterial growth distribution**

| Gender | Growth | | Total samples | P-value |
|---|---|---|---|---|
| | Positive (%) | Negative (%) | | |
| Male | 0(24.39) | 2(86.48) | 62(38.75) | |
| Female | 93(75.60) | 5 (13.51) | 98(61.25) | 0.0001 |
| **Total** | **123** | **37** | **160** | |

## Frequency distribution of Bacterial Isolates

A total 123 isolates were identified, 93 (75.60%) were *S. mutans* followed by 28 (22.76%) *S. aureus* and 2 (1.62%) *K. pneumoniae.* Among all the bacterial isolates, *S. mutans* was found to be primary and most predominant causing dental caries than other isolates. The results are shown as shown in figure 2.
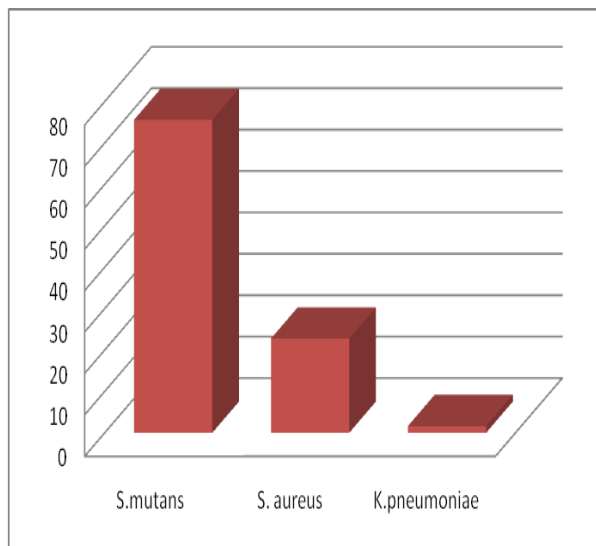


**Figure 2: Pattern of bacterial isolates among total study population**

## Pattern of Brushing habit among Study Population

Among all respondents, 109 (68.12%), 36 (22.5%) and 15 (9.37%) had brushing habit once per day, twice per day and occasionally respectively. The results are shown in figure 3.

**Table 3: Association between brushing habit and knowledge on dental caries**

| Brushing habit | Knowledge on dental caries | | Total | P- value |
|---|---|---|---|---|
| | Yes | No | | |
| Occasionally | 3 | 12 | 15 | |
| Once per day | 98 | 11 | 109 | |
| Twice per day | 27 | 9 | 36 | 0.0001 |
| **Total** | **128** | **32** | **160** | |

Among all respondents, 70 (43.75%) used fluoridated dentrifice and 90 (56.25%) hadn't use fluoridated dentrifice. The results are shown in figure 4.
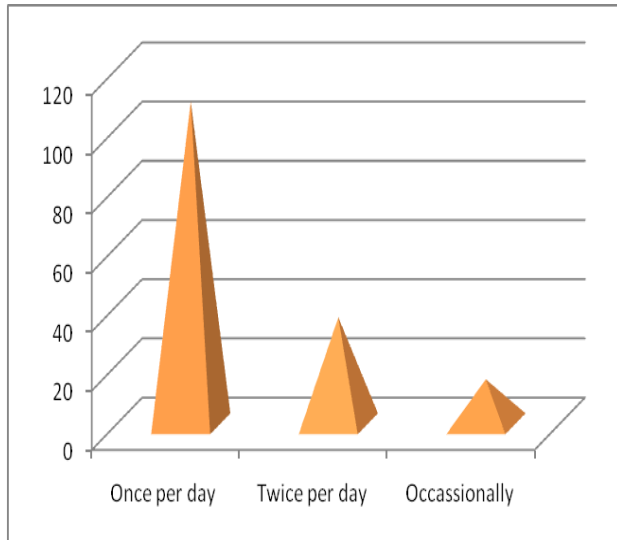
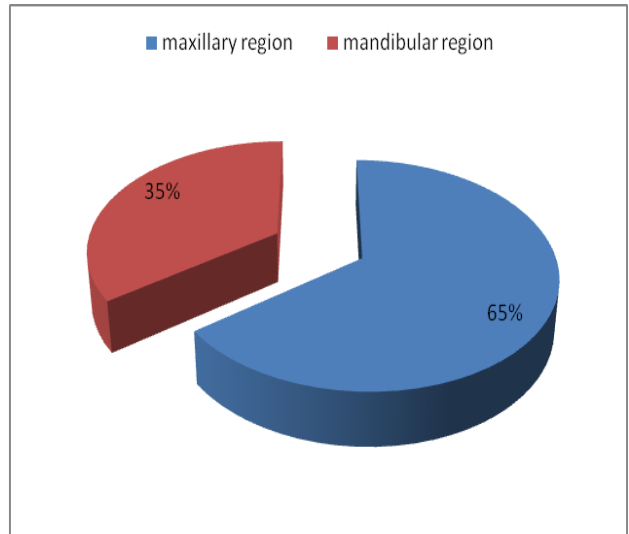**Figure 3: Frequency of brushing habit Distribution of Fluoridated Dentifrice**



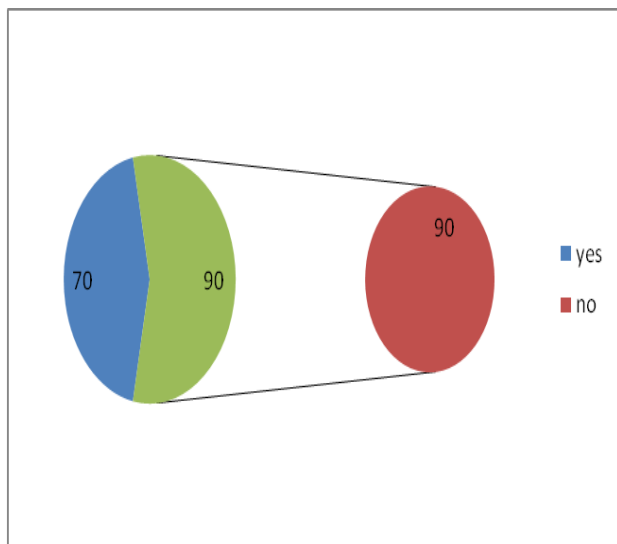**Figure 5: Dental caries distribution in terms of region of tooth**



**Figure 4: Use of fluoridated dentifrice among the adolescence**



**Figure 6: Pattern of tooth wise distribution of dental caries**

## Toothwise distribution of Dental Caries

Most of the respondents had dental caries on the maxillary region than mandibular region of tooth (figure 5). The highest number of dental caries was found on 2nd molar and 1st molar teeth followed by canine in both regions. The results are shown in figure 5 and 6.
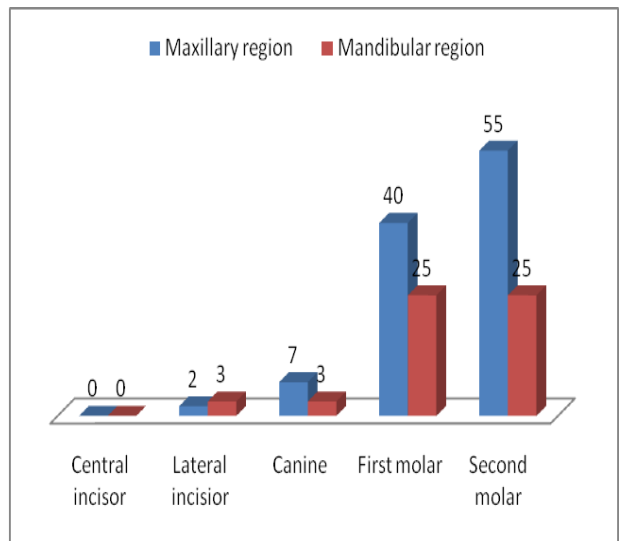
## Association between Brushing habit and Knowledge on Dental caries

Among all respondents, the knowledge on dental caries was found to be highest among the patients having the brushing habit once per day which was statistically significant (p = 0.0001). The results are shown in table 3.

**Association between Use of fluoridated dentrifice and knowledge on dental caries**

The knowledge on dental caries was found to be highest among the patients who used fluoridated dentifrice which was statistically significant (p = 0.001). The results are shown in table 4.

**Table 4: Association between use of fluoridated dentrifice and knowledge on dental caries**

| Fluoridated dentifrice | Knowledge on dental caries | | Total | P- value |
|---|---|---|---|---|
| | Yes | No | | |
| Used | 56 | 14 | 70 | 0.001 |
| Not used | 13 | 77 | 90 | |
| **Total** | **69** | **91** | **160** | |

**DISCUSSION**

Despite great improvements in the oral health of population in several countries, it is claimed that poor oral health may have a deep effect on general health, several oral diseases related to chronic diseases as well as value of life. Dental caries is the most studied oral disease in the world, the majority of studies concentrate in school children, with not enough research on the situation of the disease in young adults [15].

The prevalence of dental caries was observed in many studies. As the age advances there was rise in proportion affected by caries. In present study, the prevalence of dental caries in adolescence was found to be 33%. The adolescence age was divided in two age groups i.e. 10-14 and 15-19 years in this study. The dental caries was found to be more in age of 15-19 (57.5%) than 10-14 (42.5%) years. According to Subedi B et al (2011) showed the prevalence of dental caries in 12-13 age groups was 53.23% [16]. Adhikari RB et al (2012) reported caries prevalence in the age group 11-14 years was 52.46% respectively [17]. Dikshit P and Limbu S (2013) recognized caries prevalence in 12-13-year-olds was 41% [18]. This may be due to the majority of these adolescence consuming sugary foods such as chocolate, candy, jellies, soft drinks, etc. approximately 3–5 times daily, which may be considered one of the most important factors in high caries experience in this group [19].

The present study showed that female (61.25%) had more dental caries than male (38.75%). This may be due to female's dental eruption begins six months earlier than males, so they are exposed to cariogenic factors beforehand [20] or due to the increasing sugar consumption, low exposure to fluorides containing toothpaste and poor access to oral health care. According to Subedi B et al (2011) also reported the percentage of caries in female was slightly higher than male [16] which is in accordance with this study.

The present study showed *S. mutans* was the prominent cause of dental caries with 75.60% followed by *S. aureus* (22.76%) and *K. pneumoniae* (1.62%). *S. mutans* collect around the teeth and gums in a sticky, creamy-coloured mass called plaque which serves as a biofilm. Bacteria in a person's mouth convert sugars (glucose and fructose and most commonly sucrose) into acids such as lactic acid through a glycolytic process called fermentation. If left in contact with the tooth, these acids may cause demineralization which is the dissolution of its mineral content [1, 20]. According to Hassan-Olajokun et al (2008) reported 21.21% *S. mutans* causing caries in age group of 11-15 [20].

In this study, *S. aureus* was found to be the second most common Gram positive bacteria associated with caries which is

similar to a study conducted by Fayaz M et al (2014) at Rajah Muthiah Dental College and Hospital, Annamalai University, India [21] and Yadav K and Prakash S (2015) at Janaki Medical College Teaching Hospital, Tribhuvan University, Nepal [1]. *S. aureus* in the aetiology of oral dysaesthesia and mucositis is complicated by the diversity of the normal oral flora and by healthy carriage of *S. aureus* in some patient groups. However, the high rates of *S. aureus* are suspected in patients presenting with symptoms of oral mucosa pain, burning, erythema and swelling. Isolates of *S. aureus* are capable of producing a wide range of exfoilotive toxin and enterotoxin [1, 22].

There was a trend to increased recovery of *S. aureus* isolates from more elderly patients in contrast to previous work which found no age related trend for the recovery of *S. aureus* from a healthy population [23]. It is unclear whether this reflects changes in the oral flora associated with increasing age, medication, increased incidence of prosthetic oral devices or referral patterns. The presence of prosthetic devices within the oral cavity, such as acrylic dentures, may encourage the carriage of staphylococci [24]. In studies of denture wearing patients, carriage rates of *S. aureus* have varied from 23–48% [25, 26]. The oral carriage of *S. aureus* may be more common than previously recognised and the data collected suggests a reappraisal of the role of *S. aureus* in the health and disease of the oral cavity [27].

This study revealed least number of *K. pneumoniae* associated with dental caries. It is classically thought of as community acquired and occurring in elderly and debilitated population with underlying alcoholism, chronic lung disease or diabetes [1].

This study represents most of the patient brushed their tooth once per day which was the main factor to cause dental caries because after eating and drinking if teeth is not cleaned then there may be the chances of plaque formation quickly by the fermentable bacteria called *Streptococcus mutans* and the first stages of decay can begin. The present study also showed that 90 (56.25%) didn't use fluoridated dentrifice. Fluoride containing tooth paste is a naturally occurring mineral which helps in preventing cavities and can even reverse the earliest stages of tooth damage [28].

This study revealed molar tooth (first and second molar) followed by canine was more affected. This may be due to the anatomical structures of tooth which have lots of grooves, pits and crannies that collects food particles. As a result they are harder to keep clean than front teeth where plaque can build and bacteria can thrive between back teeth as molars, producing the acids that destroy tooth enamel [29]. According to the Dikshit P and Limbu S (2013) reported molars and incisior were more affected whereas in this study incisor was not affected due to more resistant to caries which may be due to protection by the tongue and opening of major salivary ducts near the incisors [18]. The present study evidents that the sequence of caries attack follows a specific pattern maxillary being predominantly affected by caries while the mandibular were least affected which is similar to other studies [30, 31].

The present study emphasizes on increasing status of dental caries which helps to determine the appropriate implementing programs to achieve optimal oral health care for

adolescence. This indicates that there are still shortcomings in the areas of both preventive and curative dental care. More oral health education programs in community and schools must be carried out for the control of oral diseases. These approaches should be combined with family and community-directed preventive programs.

## CONCLUSION

The present study concluded that the prevalence of dental caries in adolescence was 33%. Female had more dental caries than male and was statistically significant. Maxillary molars were more vulnerable to dental caries than mandibular molars. *S. mutans* was found more responsible to cause dental caries. Most of the respondents had knowledge on dental caries that had once per day brushing habit and those who used fluoridated dentrifice was found to be statistically significant. Acute caries results in severe pain, problem with eating, chewing, smiling and communication whereas chronic caries results in oral and pharyngeal cancers and oral tissue lesions. These are significant health concerns which have a major impact on people's daily lives and well- beings [8]. So, this study was conducted to determine the prevalence of caries on adolescence which was found to be in an increasing trend.

Thus, the current study pointed out that there is a great need for dental and oral health among adolescence. So, it is of high relevance to include preventive strategies with a major public services compromise to give attention to sick teeth, look for the implementation of preventive programs in adolescents and remarking remineralizing substances on hygienic and dietary habits for should be conducted at regular intervals of time in Nepal.

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*Correspondence to:*
**Khushbu Yadav**
Lecturer
Krishna Medical Technical Research Center, Janakpurdham, Nepal
**E-mail:** meetkhushi20@gmail.com