Research Article

The Journal of Clinical Microbiology

Frequency of Streptococci Mutans Dental Caries in Patients with Diabetes

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Received : September 02, 2023 ;
Accepted : September 03, 2023 ;
Published : October 07, 2023 ;

Abstract

Background : Patients with diabetes are more likely to develop dental caries. Streptococcus mutans is the primary bacteria in the mouth cavity that primarily consumes glucose for nourishment and results in dental caries in diabetic people. The purpose of this study was to ascertain how common S. mutans dental caries was among diabetes patients.

Method : From February 21st, 2017 to October 15th, 2018, an across-sectional study was conducted among diabetic patients visiting JUSHDC. S. mutans was isolated from a dental plague using mitis salivaris agar. Finally, SPSS software was used to analyse the data.

Results : The overall prevalence of S. mutans in this study was 81, or 67.50%. Out of the 120 individuals in the study, 77 (64.20%) were male and 49 (40.80%) tested positive for dental caries. The remaining 43 (35.60%) were female and 32 (26.70%) tested positive for S. mutans in a culture.

Conclusion : This study found that patients with diabetes had a high prevalence of dental caries. This could result in more dental decay and tooth loss, as well as economic harm, psychological repercussions, and other hazards for the populace. Thus, it is necessary to take the proper steps in health education, prevention, and treatment initiatives.

Keywords : *Dental Caries; Streptococcus mutans; Diabetic Patients*

Introduction

Dental caries is the most common chronic disease among school-age children and one of the most common health issues affecting a large portion of the global population. More than 90% of Americans suffer from dental caries, the most common and expensive infectious disease in the world [1]. Dental decay is predisposed to by frequent or high consumption of sugary foods, according to epidemiological surveys on the impact of sugar substitutes carried out by the British Nutrition Foundation. To elucidate the relationship between dental caries increments and eating habits, several dietary histories in conjunction with distinct measurements of caries increments are required [2]. Numerous research findings indicate that eating a lot of sugar raises your risk of developing certain chronic illnesses, especially dental obesity and caries [3].Seifertin 1862 [4] was the first to identify diabetes mellitus, a significant metabolic condition that causes systemic abnormalities that are also evident in the oral cavity. Atrophic alterations in alveolar processes, diseases of the salivary glands, periodontium, and oral mucosa, aberrant dentition development, and increased caries frequency and intensity are among the oral cavity's manifestations [4,5].

Diabetes mellitus may raise the risk of dental caries through a variety of, as of yet unproven, mechanisms. Others have reported that the counts of lactobacilli and Streptococcus mutans in diabetics and non-diabetics are the same, which does not support the increased proportion of S. mutans on the total cultivable aerobic microflora reported by some authors [5]. Globally, the prevalence of diabetes is increasing quickly [6].One of the main causative agents of dental caries is thought to be streptococci mutans. According to epidemiological studies, these are the most prevalent pathogens found in human dental plaque and have been shown to be prevalent [7-9]. In the Diabetes Clinic of Mekane Hiwet Hospital, Asmara, Ethiopia, a survey was conducted from October 1989 to January 1990 on 105 patients, 45 of whom were female and 60 of whom were male. The purpose of the survey was to determine the incidence of dental and periodontal problems among diabetic patients. The results indicated that dental caries was found in 79% of the patients, with no significant correlation to the patient's age or length of diabetes. These results point to the detrimental effects of diabetes on dental health by demonstrating a high incidence of dental and periodontal issues in diabetic patients [8].

Maintaining dental health is fundamental to overall health and vital to well-being. The psychological effects of oral health issues dramatically lower quality of life by interfering with speaking, eating, and other life's social and psychological domains. Periodontal disease and dental caries are the main causes of poor oral health. It causes the teeth to gradually lose if treat-

ment is not received. The primary risk factors for inadequate oral hygiene and tooth decay have been shown to be psychosocial variables and specific medical disorders including diabetes and HIV infection [1,9]. The majority of research suggested that limiting the amount of sugar added to food would help prevent conditions like dental caries that result from consuming large amounts of sugar. Sugar intake reductions would have a significant preventive effect because obesity and oral diseases are global health issues that impact a great deal of people's social, economic, and physical well-being [3, 10]. The various risk profiles that exist worldwide and are connected to lifestyle choices, living situations, and the adoption of preventive dental health systems are largely reflected in the current global patterns of oral disease. To determine the primary cause of dental diseases, socio epidemiological studies have been conducted [11].

Consequently, this prevalence study of S. mutans dental caries can provide baseline data to individuals interested in more research in the same field as well as help design successful community-based prevention and control programmes. The most prevalent public health issue worldwide, including in developed and developing nations, is the high prevalence of S. mutans, which is also a major cause of dental caries. In developing nations, particularly in sub-Saharan Africa, the issue of S. mutans dental caries in diabetic patients is growing at an accelerated rate [10,12]. However, the prevalence of dental caries among diabetes patients in Ethiopia, and specifically in the study area, is a subject of very little information. Additionally, there is disagreement over the link between diabetes mellitus and dental caries. Thus, the purpose of this study was to ascertain the frequency of S. mutans dental caries in diabetic patients who visit the diabetic clinic at Jimma University, a specialised hospital [12–15].

Material and Method

Study Design, Setting and Period

Between February 21st, 2017 and October 15th, 2018, a cross-sectional study was carried out on a total of 120 diabetic patients using the questionnaire method. The study involved patients who were referred to the diabetic clinic at Jimma University Specialised Hospital (JUSH) for follow-up and were asked to provide dental plaque for dental caries examination to JUSH Dental Clinic, Jimma, Ethiopia.

Sample Collection and Transportation Dental Plaque

Dental professionals used forceps to remove the dental plaques from each patient, which they then placed into a 2 ml tube of sterile phosphate-buffered saline (pH 7.0). The samples were processed right away in the Jimma University Microbiology Laboratory [14].

Isolation and Identification of Streptococcus mutans

To confirm that the species is streptococcus, Gramme stain was applied to the dental plaque. Next, 100µl of the sample was spread onto Mitis-Salivarius agar (MS-agar) using a sterile cotton swab. The sample was then vortexed for 30 seconds and incubated in 5% CO2 for 48 hours at 37°C. Subsequently, the number of colonies is measured; a count exceeding 250 colonies (104 cells/ml) was deemed to be culture positive. S. mutans is defined as gram-positive cocci that form glucan puddles on Mitis Salivarius agar, are catalase-negative, and ferment mannitol and lactose [1,14, 15].

Antimicrobial Susceptibility Testing

The disc diffusion method was used to test for antibiotic susceptibility in accordance with the standards established by the Clinical Laboratory Standard Institute (CLSI) [16]. A sterile cotton swab was used to evenly spread the pure colony of S. mutans bacterial suspension from brain heart infusion broth, which has turbidity matched with 0.5 McFarland standard, onto Muller-Hinton agar supplemented with 5% sheep blood. Antibiotic discs that were chosen in accordance with CLSI guidelines were then quickly added to the infected plate. The antimicrobial discs with the corresponding concentrations utilised were: amoxicillin (Aml, 25 µg), erythromycin (E, 15 µg), clindamycin (DA, 2 µg), tetracycline (TE, 30 µg), penicillin (P, 1 unit), ceftriaxone CRO, 30 µg), and chloramphenicol (C, 30 µg) from [Becton Dickinson BD, USA company]. The plates were kept in a candle jar at 35–37°C for the entire night. By measuring the zone diameter of inhibition, the antimicrobial susceptibility results were interpreted using the criteria of sensitive, intermediate, and resistant [16–20].

Statistical Analysis

With the aid of the readily available computer software programme (SPSS), version 20, the data was processed, entered, and examined. Simple descriptive statistics and cross-tabulation were employed to demonstrate the statistical relationship between dental caries and related risk factors, primarily diabetes.

Quality Assurance

All three stages of quality assurance were carried out in order to guarantee the validity and dependability of the research

findings. The pre-analytical stage was ensured by employing a dentist to collect the sample. Additionally, the test's repeatability and dependability were examined for various reagents and equipment types. Several SOPs were used and implemented during the study period to guarantee the analytical phase. Depending on the field of study, various professionals were used to interpret the results of each analysis in order to ensure the final post-analytical phase.

Exclusion and Inclusion Criteria

The study included all diabetic patients who sought treatment for dental caries at JUSH Dental Clinic. Those who took drugs, children under the age of eight at the onset of diabetes mellitus, patients with physical or mental disorders that prevented them from undergoing an oral examination, and patients sent to the dental clinics from other OPDs than the dental clinic were excluded from the study.

Dissemination of the Results

Following the completion of the data analysis, the relevant recommendations were made and the results were shared with the pathology department, JUSH Dental Clinic, Diabetes Clinic Department, Medical Laboratory Science Department, and the Jimma University student research programme.

Ethical Consideration

Before beginning data collection, administrator consent was also obtained from JUSH administration and an ethical letter from the research programme at Jimma University was obtained. Following an explanation of the study's goal, participants gave their written consent, and their clinical data was kept private. Ultimately, patients who tested positive for culture were counselled and handled appropriately at the JUSH Dental Clinic.

Results

A total of 120 study population were interviewed and their plague grew in salivary mitis media and the growth of S. mutans was examined for the detection of variables that cause dental caries of tooth. Out of which 77 (64.20%) were males and 43 (35.80%) were females and the average age of the study population was in the interval 25-29 which accounted for 52 (43.33%). The history of duration of documented diabetes ranged from 1 year up to 20 years with an average year 8 years. As we have seen from Table 1 from a total of 120 diabetic participants 81 (67.50%) were positive to S.mutans culture growth. The study also tries to see the association of different socio-demographic parameters like residence, occupational status, educational status, and other with dental caries prevalence and we found no statistically significant relationship was observed between the above sociodemographic character and the rate of dental caries of S. mutans (P-value> 0.05).

From the total 120 sample population, 98 (81.70%) were cleaning their teeth of which 70 (58.30%) were positive to culture growth of S. mutans and the rest 22(18.30%) were not clean their teeth and out of those 11 (9.20%) were positive to culture result of the bacteria Streptococcus mutans. Out of these 98 patients who clean their teeth, 78 (79.60%) were use Mefakiya (tooth stick), 9 (9.20%) were clean their teeth only by rinsing with water, 3 (3.10%) used charcoal and the left used others to clean their tooth. The study shows that 18 (18.40%) were clean their teeth by top to the bottom method, 37 (37.80%) by sideways (vertically), 2 (2, 00%) by the circular method, and the rest 41 clean their teeth by a mixed method. When we see the P-value, it is greater than 0.05 so that no statistically significant relationship was observed between the above variables and dental caries of S. mutans (Table 2). The study was done on the sweet intake habit and shows that from the total 120 sample population 47 (39.20%) have this habit of which 32 (68.09%) are positive to culture result of S. mutans and, 73 (60.80%) have no the habit of sweet intakes of which 49 (67.12%) was positive. Also here; the culture result of S. mutans and the relationship between behavioral and other risk factors to tooth decay are not statistically associated (P-value >0.05) (Table 3).

From the sample population, 20 (16.70%) have gum bleeding risks to their teeth of which 18(15.00%) were positive to culture growth of S. mutans and 100 (83.30%) have no this risk but out of this 63 (52.50%) were positive to culture growth of S. mutans. According to our study finding was a statistically significant between the rate of dental caries of S. mutans and gum bleeding (P-value=0.0019). But no statically significant association is seen between the rate of dental caries and tooth decay and the type of tooth decayed (P-value>0.05) (Table 4).

From a total of 120 participants, 49 (40.80%) have no debris or stains on their oral area, 64 (53.30%) have soft debris covering not more than one-third of the teeth, 4 (3.30%) have soft debris covering more than one-third of the teeth, 3 (2.50%) have soft debris covering more than two- thirds of the tooth surface. Based on the study finding statically significant association is observed in between culture result of S. mutans for dental caries with oral debris (P-value=0.003) (Table 5).

Discussion

According to this study finding out of 120 total diabetic patients, 81 (67.50%) were positive to the culture growth result of S. mutans and showed that there is a strong statistically significant association between dental caries and being diabetic (p-value= 0.002). In the previous study, the association of diabetes with dental caries was not identified which makes this study different from most previous studies [12,13,15]. Some studies try to show that diabetic Mellitus has some association with dental caries, such as studies conducted in Thailand in 2006 on 105 patients with type 2 DM and studies conducted in Mekane hiwot hospital, Asmara, Ethiopia on diabetic patients show that DM has statistically association with dental caries which makes these similar to this study [15,8]. In this study, the positivity rate of growth of S. mutans on culture selective media was 67.50% which is less than the study done in Latin America and Asia (75%) by WHO on school children and greater than the finding of the study conducted in British in 2010 on 259 adolescent with type 1 DM and study conducted in Mekane hiwot hospital Asmara, Ethiopia to assess the incidence of dental caries on diabetic patients (79%) [1]. This is due to the difference in the different lifestyles of people and different habits of the use of sugary foods which are the main cause of dental caries. A study conducted in private hospitals in Bangalore, India 2014 on 400 subjects showed that there was a statistically significant association between age and root caries (elders are riskier than younger) in contrast in this study these two variables do not have a statistically significant association with dental caries [21]. The finding of this study shows that gum bleeding and oral hygiene have a statistically significant association with dental caries (P-value 0.019 and 0.003 respectively). Here the study shows that the two independent variables have a high risk to dental caries which is not identified in any other previous studies. But the other independent variables have no statistically significant association with root caries in this study which makes it different from other studies. This difference between studies may be due to the different attitudes of the study population towards those two dependent variables.

The other predisposing factors like socio-demographic factors (sex, age, educational status,occupation, place of residence), knowledge and practical questions on tooth cleaning (like a habit of cleaning teeth, what do you use to clean teeth, when and how do you clean teeth, tooth brushing), behavioral and other risk factors to teeth decay (like cigarette smoking, chewing chat, alcohol drinking, sweet intakes, soft drinking, xerostomia) and clinical data's on oral health (like access to fluoridation, previous tooth decay, type of tooth decayed plaque index, calculus index, gingival index, type of medication for DM and duration of DM) have no statistically significant association with dental caries (P-value>0.05) even if some of these factors have an association in the other previous studies. This main variation between studies may be due to a special attitude of the study population to those independent variables and due to variation of lifestyle among study participants in different study areas and periods.

Conclusion and Recommendation

In this study, a high prevalence rate of dental caries of S. mutans was found and the finding shows that a statistically significant association is seen between the rate of dental caries and factors like oral debris and bleeding. This may lead to further caries of a tooth which causes the total loss of tooth parts which causes to suffer economic loss, psychological infect, and other risks to the patients.

Depend on this study finding indication we recommend that to decrease the prevalence of dental caries due to S. mutans appropriate prevention, control and curative activities must be developed in the population. This technique can be addressed to the target group by different mechanisms especially by giving health education that focuses on oral health and the way of cleaning and washing teeth to prevent dental caries. Based on the finding, the gap is mainly seen in the factors like how to keep oral health, how to clean teeth, system of cleaning and curing of teeth mechanisms must be addressed by health education and tooth washing dental clinics must be easily available. Also, special health information and preventive action must be given to different factors especially gum bleeding and oral debris.

Declarations

Ethics approval and consent to participate were taken from the study participants. This study was approved by the Ethics Committee of Jimma University, College of Health Science, Department of Medical laboratory Science.

Acknowledgment

We would like to acknowledge Jimma University, College of health science, Medical laboratory Department, and Jimma University specialized hospital laboratory department, and dental clinic department health professionals. Our acknowledgment is also extended to Dr. Melaku who helps me in the collection of this sample. The study participants also high acknowledge this study for their voluntarism participation in this study.

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