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Article

Evaluation of Oral Bacterial Levels in Children and Adult

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Abstract: The human oral cavity harbors one of the most complex and diverse microbial ecosystems in the body, comprising numerous bacterial genera that exist in dynamic equilibrium. Disruption of this balance, particularly under the influence of systemic conditions and lifestyle factors, has been associated with increased pathogenic activity and antimicrobial resistance. This study aimed to evaluate and compare oral bacterial profiles and antibiotic susceptibility patterns across different population groups, including adult diabetic smokers, non-smoking adults, and children with and without dental caries, in order to identify variations in microbial composition and resistance patterns associated with age and systemic risk factors. A total of 50 oral swab samples were collected and distributed across three groups: 25 adult and 25 children). Bacterial isolates were identified and subjected to antibiotic susceptibility testing using the disk diffusion method. Gram-positive organisms, predominantly Streptococcus spp. and Staphylococcus spp., were the principal isolates across all groups. Diseased groups demonstrated higher frequencies of mixed microbial growth. Adult diabetic smokers exhibited the highest antibiotic resistance rate (53%), followed by children with dental caries (40%), whereas control groups showed lower resistance levels. Overall, adults demonstrated higher resistance compared to children (48% vs. 36%). Systemic conditions such as diabetes mellitus, combined with smoking, significantly promote oral microbial dysbiosis and antimicrobial resistance. The oral cavity serves as an important reservoir for resistant organisms, highlighting the need for targeted surveillance and antimicrobial stewardship in high-risk populations.

Keywords: oral microbiome, dental caries, diabetes, smoking, oral dysbiosis

Introduction

The human oral cavity represents one of the most complex microbial ecosystems in the body, harboring a diverse community of microorganisms including bacteria, fungi, viruses, and protozoa. Among these, bacteria constitute the predominant component of the oral microbiota. This environment is highly favorable for microbial growth due to the presence of constant moisture, nutrients, epithelial debris, and a stable temperature, all of which support colonization and biofilm formation [1], [2].

The oral cavity is colonized by numerous bacterial genera such as Streptococcus, Lactobacillus, Staphylococcus, Veillonella, and Bacteroides. These microorganisms interact in a dynamic and competitive manner, leading to the formation of complex multispecies biofilms. At birth, the oral cavity is nearly sterile; however, colonization begins rapidly within hours, primarily by Streptococcus viridans, which remains a dominant species throughout life [3], [4].

With the eruption of teeth, the oral microbiome undergoes significant changes, becoming more diverse and increasingly populated with anaerobic bacteria such as Prevotella, Fusobacterium, and Actinomyces. This shift reflects the increasing complexity of the oral environment and contributes to the development and stability of dental biofilms [5].

The composition of oral microbiota is influenced by several factors, including age, diet, oral hygiene, and immune status. In children, the microbiome is more dynamic and continuously evolving, whereas in adults it tends to stabilize but remains susceptible to lifestyle factors such as smoking and systemic diseases [6], [7].

Imbalance in the oral microbial community, known as dysbiosis, plays a critical role in the development of oral diseases such as dental caries, gingivitis, and periodontitis. Dental plaque, a structured microbial biofilm, is considered a major etiological factor due to its resistance to antimicrobial agents and host defense mechanisms [8].

Recent advancements in microbiological and molecular techniques, including culture methods and polymerase chain reaction (PCR), have significantly improved the identification of oral bacteria. Additionally, the increasing concern of antimicrobial resistance has highlighted the importance of antibiotic susceptibility testing in managing oral infections [9], [10].

Aims of study : evaluate and compare oral bacterial profiles in different age groups, particularly children and adults, in order to identify variations in microbial composition and associated risk factors, ultimately contributing to improved preventive and therapeutic strategies in oral health.

Materials and Method

The present study was designed to investigate the differences between specific groups based on health conditions and lifestyle factors. A total of fifteen samples were collected and categorized into three main groups. The first group consisted of 15 diabetic patients who are smokers, representing individuals exposed to both metabolic and environmental risk factors. The second group included 10 smokers without diabetes, allowing for the evaluation of the isolated effect of smoking. The third group comprised 15 children, some with dental caries and 10 others without, in order to explore variations related to oral health status.

Equipment and Instruments

The following equipment and instruments were utilized in the current study.

Figure 1. Sample taking instruments should be sterile ready and individually coated nylon or cotton. Sterile saline sometimes moisten the swab before use.

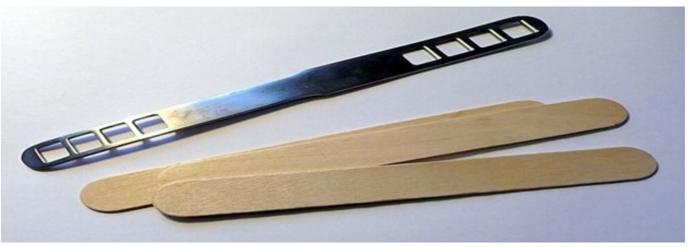

Figure 2. (Tongue depressor) : this is a sample tool used while taking a swab to help the examiner see the swab area. It is a flat stick (often wooden or plastic) use to gently press the tongue down.

Why use it in the examination of oral bacteria ?
Because it prevent the tongue from blocking vision. Allows the throat, tonsils, or soles of the mouth to be seen more clearly without touching other area to avoid contamination. Should be sterile or clean.
Children Differences in Oral Bacteria Between Children and Adults.
Children:-
Higher levels of Streptococcus Mutans and Lactobacillus spp.
Lower microbial diversity.
Rapid microbiome changes during tooth eruption.
Higher risk for early childhood caries.
Adults:-
More anaerobic Gram-Negative bacteria.
Higher prevalence of periodontal pathogens.
Stable but disease-linked microbial communities.
Study Design based on : 50 Sample
(Group1) 15 samples of Adults diabetic smokers.
(Group2)10 samples of Adults diabetic non-smokers.
(Group3) 15 Samples of Children with dental caries.
(Group4) 10 Samples of Children without dental caries.

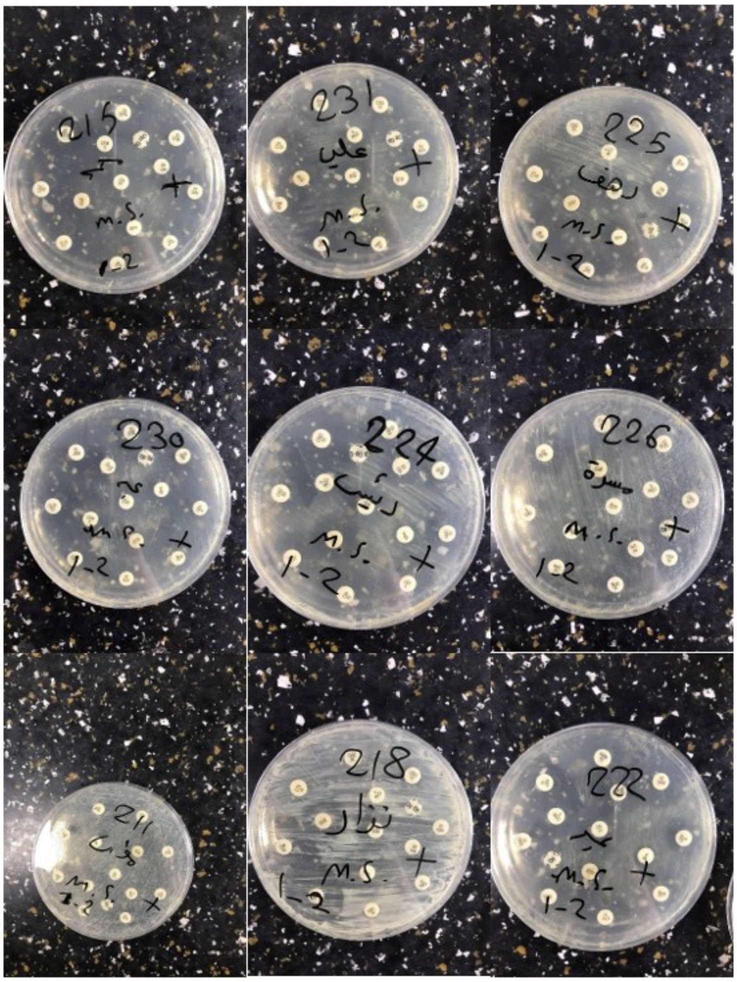

Figure 3. Agar plates showing the antibiotic susceptibility test of oral bacteria using the disk diffusion method. Bacterial isolates were obtained from different groups, including diabetic adults, smokers, children with dental caries, and caries-free children. The varying zones of inhibition around antibiotic disks indicate differences in bacterial sensitivity and resistance to the tested antibiotics

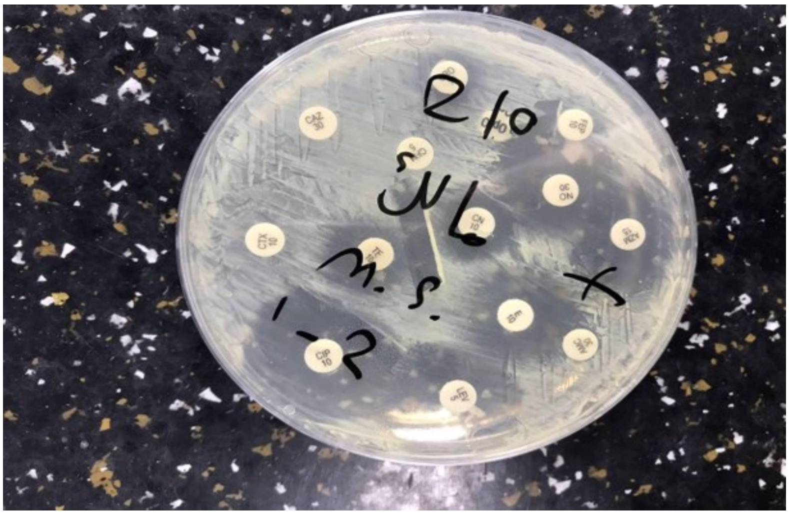

Figure 4. Partial Antibiotic Resistance Pattern of Oral Bacterial Isolate Using the Disk Diffusion Method

Notes on this dish :

Bacterial growth is evident and present on most of the surface of the plate, There is Multi-Distributed Antibiotic Tablets

We note :

a. Some discs are surrounded by small inhibition halos.
b. Some of the tablets are almost around a halo.

This indicates that the bacteria in the figure (4):-

a. It has partial resistance, Because some antibiotics did not affect
b. She has limited sensitivity to some antibiotics, Due to the presence of small halos around some of the most.

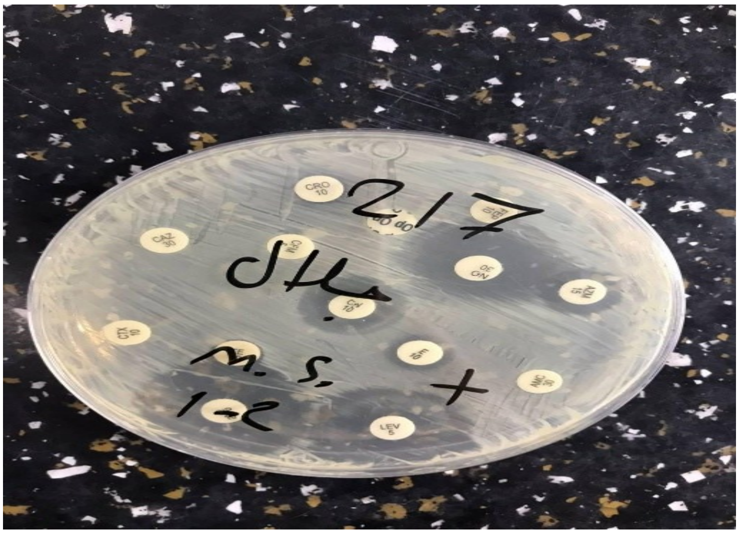

Figure 5. High-Level Antibiotic Resistance Pattern of Oral Bacterial Isolate Using the Disk Diffusion Method

The sample labeled figure (5) demonstrated a high level of antibiotic resistance, as indicated by the absence or minimal presence of inhibition zones around most antibiotic disks. This suggests that the isolated oral bacteria may possess multidrug resistance characte.

The oral environment helps the growth of stronger and more resistant bacteria.

Result

The bacterial isolates obtained in this study were predominantly Gram-positive organisms. mainly belonging to *Streptococcus spp*. and *staphylococcus spp* , which were detected in the majority of samples across both diseased and control groups.

The distribution of bacterial isolates varied between groups. diseased groups(adults with diabetes and smoking habits and children with dental caries) showed a higher frequency of mixed microbial growth compared to control groups showed.in contrast control groups showed

showed simpler microbial patterns, mainly dominated by *streptococcus* and *staphylococcus* species.

Antibiotic Sensitivity and Resistance

The analysis of antibiotic susceptibility showed variations between the studied groups.

Group High (%) Intermediate (%) Resistant (%)

Table 1. Antibiotic Susceptibility and Resistance Profiles among Adult Diabetic Smokers and Control Subjects

Group	High% sensitive	Intermediate%	Resistant%
Patent with diabetic(adult)(n=15)	20%	27%	53%
Control(n=10)	40%	20%	40%

In table (1) showing Among adult patients with diabetes and smoking habits, the percentage of resistant isolates was the highest (approximately 53%), while sensitive isolates accounted responses were approximately 20%.

In adult control subject s, a lower percentage of resistances was observed (arround40%),with higher sensitivity levels(approximately 35%) compared to diseased adults.

Table 2. Antibiotic Susceptibility and Resistance Profiles among Children with Dental Caries and Control Subjects

Group	High%	Intermediate%	Resistant%
Patent with dental carries(children) (n=15)	27%	33%	40%
Control(n=10)	40%	30%	30%

In table (2) showing children with dental caries, resistance levels s were higher (approximately 40%) compared to control children.in contrast, control children showed the highest sensitivity percentage (approximately levels (around 30%).

Table 3. Comparison of Antibiotic Susceptibility and Resistance Profiles between Children and Adults

Group	High%	Intermediate	Resistant
Children(n=25)	36%	28%	36%
Adult (n=25)	28%	24%	48%

In table (3) the comparsion between chlidren and adults showed that adults had higher percentage of antibiotic resistance, while children demanstrated higher sensitivity. The indicates apossible association between age and antimicrobia; resistance

Discussion

The present study demonstrated that Gram-positive bacteria, particularly Streptococcus spp. and Staphylococcus spp., were the predominant isolates across all groups, which is consistent with recent findings indicating that these genera dominate the oral microbiome under both healthy and diseased conditions [11]

The higher prevalence of mixed microbial growth in diseased groups reflects microbial dysbiosis, a condition characterized by disruption of the normal oral microbial balance and increased pathogenic diversity [12].

Recent studies have confirmed that systemic conditions such as diabetes significantly alter the oral microbiota composition and promote the growth of pathogenic and resistant species [13]

Additionally, smoking has been shown to exacerbate microbial imbalance by modifying the oral environment and enhancing bacterial virulence and resistance mechanisms [14], [15]

The elevated antibiotic resistance observed among diabetic adults in the present study is supported by recent evidence indicating that hyperglycemia and immune dysfunction contribute to the persistence and selection of resistant bacterial strains [16].

Furthermore, frequent exposure to antibiotics in chronic conditions such as diabetes has been linked to the selection of multidrug-resistant organisms [17], [18].

In children with dental caries, the increased resistance levels can be explained by the presence of oral biofilms, which act as protective environments that reduce antibiotic penetration [19].

Biofilms also facilitate horizontal gene transfer between bacteria,

The lower resistance observed in control groups reflects a more stable microbiome with reduced selective pressure for resistance [13].

The comparison between adults and children revealed higher resistance in adults, which may be attributed to cumulative antibiotic exposure over time [20].

Age-related differences in immune response and microbiota composition also play a significant role in shaping antimicrobial susceptibility patterns [21].

Overall, these findings support recent global evidence that the oral cavity serves as an important reservoir for antimicrobial resistance and contributes to its dissemination [22], [23].

Conclusion

The present study investigated oral bacterial profiles across different groups, including diabetic adult smokers, non-diabetic adult smokers, and children with and without dental caries, with a focus on microbial composition and antibiotic susceptibility patterns. The findings confirmed that Gram-positive bacteria, particularly Streptococcus spp. and Staphylococcus spp., were the predominant isolates across all studied groups, consistent with their established role as dominant members of the oral microbiome.

The results also highlighted the role of biofilm formation in promoting antimicrobial resistance, even at an early age. In contrast, control groups among both adults and children showed relatively higher antibiotic sensitivity, suggesting that a balanced oral microbiome with limited pathogenic pressure is associated with more favorable antimicrobial susceptibility profiles.

Comparison between age groups revealed that adults carried a higher burden of antibiotic-resistant organisms than children. This difference may be attributed to prolonged and cumulative exposure to antimicrobial agents, age-related changes in immune response, and accumulated microbial dysbiosis over time. In addition, the greater structural maturity and microbial diversity of adult oral biofilms may facilitate horizontal gene transfer of antimicrobial resistance traits, thereby contributing to the higher prevalence of resistant bacterial strains observed in adults.

Recommendations

a. Routine oral microbiological screening should be incorporated into the management protocols of high-risk patients, particularly diabetic individuals and smokers, given their elevated rates of antibiotic-resistant oral bacteria.
b. Antibiotic stewardship programs should be reinforced in dental and medical settings to reduce the selective pressure that drives multidrug resistance, especially in chronically ill populations.

c. Early intervention in children is strongly advised. Monitoring and controlling Streptococcus mutans levels from an early age, combined with dietary counseling to reduce fermentable carbohydrate intake, can significantly reduce the risk of early childhood caries and the emergence of resistant strains.
d. Longitudinal studies with larger sample sizes are needed to better characterize the progression of oral microbial resistance across different age groups and systemic conditions.
e. Patient education regarding the importance of oral hygiene, smoking cessation, and glycemic control should be emphasized, as these factors directly influence the oral microbiome composition and bacterial resistance profiles.
f. Further molecular studies using advanced techniques such as PCR and next-generation sequencing are recommended to more precisely identify resistant species and resistance genes within oral biofilms.

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