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Isolation ,Identification ,and Antibiotic Susceptibility of Bacterial Pathogens Associated with Gingivitis and Dental Caries in Patients Attending Dental Clinics in Tikrit ,Iraq

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Abstract:

This study aimed to isolate and identify bacteria associated with gingivitis and dental caries in patients attending dental clinics in Tikrit ,Iraq ,from October 2024 to January .2025 A total of 95 clinical samples were collected from gingival tissues and dental abscesses under aseptic conditions and cultured on selective and differential media ,including Blood agar for hemolysis pattern observation, MacConkey agar for isolating Gram-negative enteric bacteria ,Mannitol salt agar for staphylococci isolation ,and Nutrient agar for general bacterial growth .Identification was based on morphological, microscopic ,and biochemical characteristics ,including the IMViC series ,catalase ,oxidase ,motility, and urease tests .Antibiotic susceptibility testing was performed using the Kirby-Bauer disk diffusion method on Mueller-Hinton agar ,and results were interpreted according to the Clinical and Laboratory Standards Institute) CLSI (2025 ,guidelines .The results revealed a predominance of *Staphylococcus lentus* ,(47.4%) followed by *Enterococcus gallinarum* ,(15.8%) *Aeromonas salmonicida* ,*Klebsiella oxytoca* ,and other species .Most isolates exhibited high susceptibility to carbapenems) Meropenem, Imipenem (and good activity with aminoglycosides) Gentamicin ,Amikacin ,(whereas high resistance was observed to penicillin ,erythromycin ,metronidazole ,and third-generation cephalosporins) Ceftazidime .(The findings highlight the necessity of performing susceptibility testing prior to treatment to ensure optimal antibiotic selection ,emphasize the importance of promoting oral health awareness programs ,and support the integration of molecular diagnostic techniques for early detection of oral pathogens and monitoring of resistance patterns.

Keywords : Oral microbiota ,Gingivitis ,Dental caries ,Antibiotic resistance ,*Staphylococcus lentus*.

عزل وتحديد الحساسية للمضادات الحيوية للبكتيريا المسببة لالتهاب اللثة وتسوس الأسنان لدى المرضى في عيادات الأسنان بمدينة تكريت، العراق

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مستخلص:

هدفت هذه الدراسة إلى عزل وتحديد الأنواع البكتيرية المرتبطة بالتهاب اللثة وتسوس الأسنان لدى المرضى الذين يرتادون عيادات الأسنان في تكريت، العراق، خلال الفترة من أكتوبر 2024 إلى يناير 2025. تم جمع 95 عينة سريرية من أنسجة اللثة وخراجات الأسنان تحت ظروف معقمة صارمة. تم زراعة العينات على أوساط انتقائية وفارقة، بما في ذلك أغار الدم لملاحظة أنماط التحلل الدموي، وأغار ماكونكي لعزل البكتيريا المعوية سالبة الغرام، وأغار المانيتول الملحي لعزل أنواع المكورات العنقودية، والأغار الغذائي لدعم نمو البكتيريا العامة. تم تحديد البكتيريا اعتمادًا على الصفات المورفولوجية والمجهرية والاختبارات البيوكيميائية، بما في ذلك سلسلة IMViC، واختبارات الكاتالاز، والأكسيداز، والحركة، واليورياز. وقد تم إجراء اختبار الحساسية للمضادات الحيوية باستخدام طريقة Kirby-Bauer للانتشار على الأقراص على أغار Mueller-Hinton، وتم تفسير النتائج وفقًا لإرشادات المعهد الأمريكي للمعايير المختبرية السريرية (CLSI، 2025) . أظهرت النتائج أن المعدل الأعلى للعزلات كان لـ *Staphylococcus lentus* بنسبة 47.4٪، تلتها *Entero-coccus gallinarum* بنسبة 15.8٪، بالإضافة إلى *Aeromonas salmonicida* و *Klebsiella oxytoca* وأنواع أخرى. أظهرت معظم العزلات حساسية عالية تجاه Meropenem، Imipenem ونشاطًا جيدًا مع الأمينوغليكوزيدات Ami-kacin ، Gentamici، في حين لوحظ مقاومة عالية تجاه البنسلين والإريثروميسين والميترونيدازول والسيفالوسبورينات من الجيل الثالث Ceftazidime . تؤكد هذه النتائج على أهمية إجراء اختبار الحساسية للمضادات الحيوية قبل العلاج لتوجيه العلاج الفعال. علاوة على ذلك، تسلط الضوء على ضرورة تعزيز برامج التوعية بصحة الفم، وتدعم دمج التقنيات الجزيئية التشخيصية للكشف المبكر عن مسببات الأمراض الفموية ومراقبة أنماط المقاومة للمضادات الحيوية بشكل مستمر.

الكلمات المفتاحية: الميكروبات الفموية، التهاب اللثة، تسوس الأسنان، مقاومة المضادات الحيوية، *Staphylococcus lentus*.

Introduction:

The oral cavity harbors a complex community of microorganisms ,collectively referred to as the normal oral flora or oral microbiota .This community includes more than 700 identified bacterial species ,with common genera such as Streptococcus ,Actinomyces, Veillonella ,and Staphylococcus ,in addition to fungi like Candida albicans in low abundance .Under normal conditions ,these microorganisms exist in a symbiotic relationship with the host, contributing to colonization resistance against pathogens ,modulation of the immune response ,and maintenance of oral ecological balance .This relationship can deteriorate in the mouth, and disease can occur .This is usually associated with major changes in oral biology from external sources ,such as antibiotic treatment or a high intake of fermentable carbohydrates in the diet ,or from internal changes ,such as changes in the integrity of host defenses following drug therapy ,which affect the normal stability of bacteria and the presence of microorganisms in normally inaccessible sites .For example ,when oral bacteria enter the bloodstream after tooth extraction or other trauma ,they are disseminated to distant organs ,where they can cause abscesses .Bacteria that can cause disease in this way are called opportunistic pathogens ,and many oral microorganisms have the ability to behave in this way .Most individuals ,at some point in their lives ,experience episodes of oral disease resulting from an imbalance in oral bacteria[1].

Oral bacteria cause two of the most prevalent and impactful diseases in humans worldwide :dental caries and periodontal disease . [2] Dental caries is the breakdown of enamel or root surfaces and demineralization by acid produced primarily from the metabolism of fermentable carbohydrates present in the diet by bacteria that colonize dental plaque .Dental plaque is also associated with periodontal pathogens, as the host‘s inflammatory response increases as a result of increased plaque accumulation around the gums ,leading to damage to the supporting tissues of the teeth . [3]Oral bacteria are normally in a dynamic equilibrium .When this balance is disturbed ,the natural

flora of the mouth becomes disturbed, leading to the formation of films commonly called plaque .The complexity of the oral biofilm microflora has made it almost impossible to develop effective treatments to prevent caries and gum disease .Bacteria have developed mechanisms to adhere to the plaque by binding to various components within it ,thus providing the basic substrate for the formation of dental plaque .Dental plaque is a biofilm or mass of bacteria that settles between ,behind ,or on the front of teeth .Initially ,it is a colorless, sticky deposit ,but if not removed ,it develops into a yellowish-white or pale yellow film on the surfaces of teeth.[4]

Excessive carbohydrate intake causes the accumulation of acidic products within the mature plaque ,leading to a decrease in pH .Furthermore ,[5]the number of acid-tolerant bacteria will increase significantly or the pathogenicity of the bacteria will be enhanced. In this case ,the non-pathogenic plaque will change into a pathogenic plaque and produce a large amount of material that can cause tooth decay .Caries has been linked to some types of bacteria ,such as *Streptococcs* ,which are the main culprits of tooth decay .However, the results of studies using molecular identification techniques have indicated that the disease is associated with other bacterial communities .[6] Oral diseases such as gingivitis and dental caries are among the most common health problems worldwide ;however, the microbial patterns and their antibiotic resistance profiles vary significantly between geographical regions due to factors such as dietary habits, oral hygiene practices ,and patterns of antibiotic use .In Iraq ,particularly in Salah Al-Din Governorate ,there is a scarcity of updated data on the bacterial etiology of these diseases and their resistance patterns ,which may hinder optimal treatment selection and increase the risk of antibiotic misuse and rising resistance rates .Tikrit was selected as the study site because it is a major urban center in Salah Al-Din Governorate ,receiving a large number of patients from both urban and rural areas ,thereby providing a representative sample of the local population .Moreover ,Tikrit Teaching Hospital and the College of Dentistry clinics offer an ideal setting for obtaining diverse clin-

ical samples ,in addition to having the necessary laboratory infrastructure for conducting advanced bacteriological analyses .The aim of this study is to investigate the bacterial spectrum associated with gingivitis and dental caries in patients attending dental clinics in Tikrit ,Iraq ,by isolating and identifying the causative bacterial species using morphological ,microscopic ,and biochemical characteristics ,in addition to determining their antibiotic susceptibility patterns according to international standard guidelines.

Material and methods

Collection and Culturing of Samples

A total of 95 clinical specimens were collected between October8 ,2024 and January 11, 2025 from patients clinically diagnosed with gingivitis and dental caries at the Specialized Dental Center of Tikrit Teaching Hospital and the dental clinics of the College of Dentistry. Inclusion criteria included :age between 18and 60 years ,both sexes ,confirmed diagnosis by a dentist ,and no history of antibiotic or antiseptic mouthwash use for at least two weeks prior to sampling. Exclusion criteria included :patients with immunological disorders ,chronic systemic diseases affecting oral health such as diabetes mellitus ,or those who had recently received immunosuppressive drugs or antibiotictherapy. The sample size (95 specimens) was determined based on the average daily attendance rate in the participating centers ,ensuring adequate demographic representation in terms of age ,sex, and clinical condition .Samples were collected using sterile cotton/rayon swabs supplied with Amies transport medium .Swabs were obtained from gingival tissues or dental abscesses under strict aseptic conditions to minimize contamination .All samples were immediately placed in transport medium and transferred to the microbiology laboratory within 30 minutes of collection ,while adhering to biosafety level 2 (BSL-2) precautions during handling and processing.

Samples were inoculated onto various culture media ,including Blood agar for the isolation of pathogenic bacteria and observation of hemolytic patterns ;plates were incubated at 37 ^{o}C for 24 hours under aerobic conditions,

with anaerobic incubation applied when necessary to recover obligate anaerobic oral bacteria , MacConkey agar for the isolation and identification of Gram-negative enteric bacteria ,Mannitol salt agar for the isolation and identification of staphylococcis and Nutrient agar for general bacterial growth .Preliminary identification was based on morphological ,microscopic, and standard biochemical characteristics following established procedures [7]Bacterial isolates were preserved on Brain Heart Infusion agar supplemented with 15% glycerol and stored at 20◦C to maintain viability for subsequent analyses .Antimicrobial susceptibility testing was performed using the Kirby–Bauer disk diffusion method according to the guidelines of the Clinical and Laboratory Standards Institute (CLSI ,2025) ,employing standard antibiotic discs and following all biosafety protocols.

Antibiotic Sensitivity Test

Antibiotic susceptibility testing was conducted for all bacterial isolates against 12 commonly used antibiotics, as listed in Table 1 The Kirby-Bauer disk [8] diffusion method was employed using Mueller-Hinton Agar, 2–1fresh bacterial colonies were transferred into a test tube containing 5 ml of normal saline ,and the suspension was adjusted to match the turbidity of 0.5McFarland standard ,equivalent to approximately $10^8 \times 1.5$ CFU/ml A sterile cotton swab was dipped into the suspension ,and the excess fluid was removed by pressing the swab against the inner wall of the tube .The swab was then streaked evenly in three directions over the surface of pre-prepared Mueller-Hinton Agar plates to ensure uniform distribution .The plates were left to dry for 5–4 minutes .Antibiotic discs were then placed on the surface using sterile metal forceps ,with gentle pressure to ensure proper adherence .Each plate contained six antibiotic discs. The plates were incubated aerobically at°37 C for 24 hours After incubation, the diameters of inhibition zones were measured in millimeters using a ruler, and the results were interpreted according to the international standards provided by the CLSI2025 .

Table 1.Antibiotics used in the study with code ,concentration and manufacturer

Antibiotic	Code	concentration Disk	Manufacturer
Amoxicillin	AMX	µg 25	UK ,Oxoid
Meropenem	MEM	µg 10	UK ,Oxoid
Imipenem	IPM	µg 10	UK ,Oxoid
Clindamycin	DA	µg 2	UK ,Oxoid
Amikacin	AK	µg 30	UK ,Oxoid
Metronidazole	MTZ	µg 5	UK ,Oxoid
Gentamicin	CN	µg 10	UK ,Oxoid
Erythromycin	E	µg 15	UK ,Oxoid
Penicillin	P	units 10	UK ,Oxoid
Ceftazidime	CAZ	µg 30	UK ,Oxoid

Results and Dissection

Isolation and Identification of Bacterial Species:

The culture and microscopic diagnosis were performed and the diagnosis was confirmed with the Vitik .2 The results of the Tests revealed that the most predominant isolate was *Staphylococcus lentus* 45 isolates ,followed by *Enterococcus gallinarum* 15 isolates, Other bacterial species isolated included *Aeromonas salmonicida*10 isolates ,*Klebsiella oxytoca* 8 isolates, *Rothia kristinae* 5 , isolates ,and *Bacillus cereus* 2 isolates.

These results indicate a predominance of Gram-positive cocci ,particularly Staphylococcus species ,among the oral infections studied ,along with a smaller proportion of Gram-negative bacilli and other opportunistic bacteria.

These findings are in agreement with previous studies indicating the predominance of Gram-positive cocci in oral infections .For example ,a study by [9] reported that *Staphylococcus* and *Enterococcus* species were the most common isolates from periodontal and endodontic infections ,while Gram-negative bacilli such as *Klebsiella* were detected at lower frequencies. Such microbial profiles highlight the polymicrobial nature of oral infections

and the importance of both Gram-positive and Gram-negative organisms in the pathogenesis of gingivitis and dental caries.

Laboratory Identification

Morphological Identification

The bacterial isolates recovered from gingival and dental abscess samples were identified based on their colonial morphology ,hemolytic patterns, and growth characteristics on the selective and differential media used in this study.

Staphylococcus lentus appeared on blood agar as medium-sized ,smooth, round ,opaque colonies with a creamy appearance .It exhibited no or slight hemolysis) γ-hemolysis .(On mannitol salt agar ,it showed visible growth due to its tolerance to high salt concentrations ;however ,the colonies did not ferment mannitol and therefore remained pink without any color change.

Enterococcus gallinarum formed small ,translucent to grayish colonies on blood agar ,typically demonstrating alpha hemolysis) a green discoloration around the colonies .(On MacConkey agar ,it exhibited weak or no growth due to its Gram-positive nature.

Aeromonas salmonicida produced round ,smooth colonies on blood agar with slight β-hemolysis .On MacConkey agar ,it appeared as non-lactose fermenting colonies (colorless).

Klebsiella oxytoca formed large, mucoid ,pink colonies on MacConkey agar as a result of lactose fermentation .On blood agar ,it exhibited large, smooth ,convex ,and mucoid colonies without hemolysis.

Rothia kristinae appeared on blood agar as small ,white to grayish colonies with a dry texture and typically showed no hemolysis .It did not grow on MacConkey agar due to its Gram-positive nature.

Bacillus cereus showed large ,flat, irregular colonies on blood agar ,with clear zones of β-hemolysis .These phenotypic observations were consistent with the known growth characteristics of the respective species ,and they formed the basis for further biochemical and molecular identification steps. As show as in Figure1 .

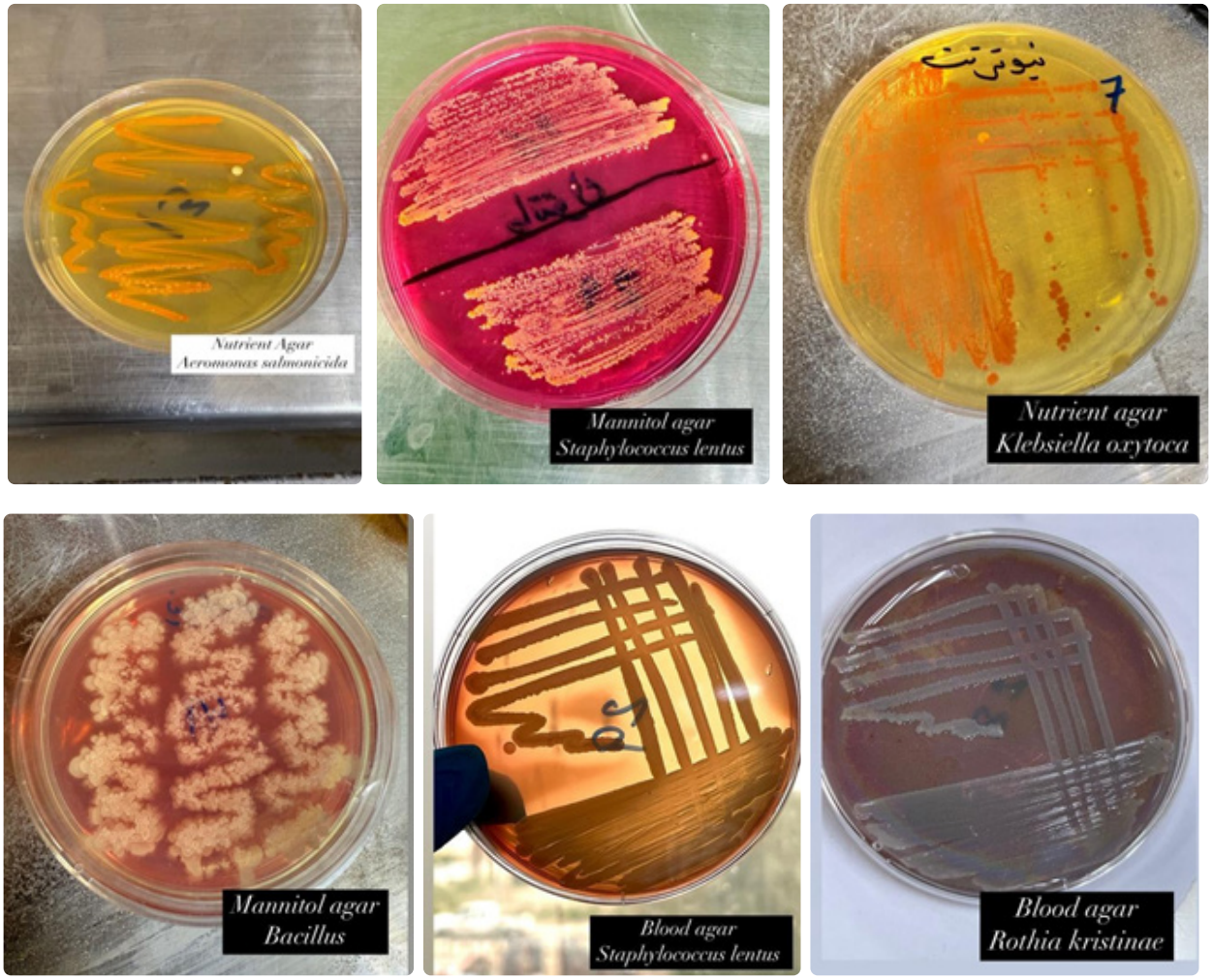
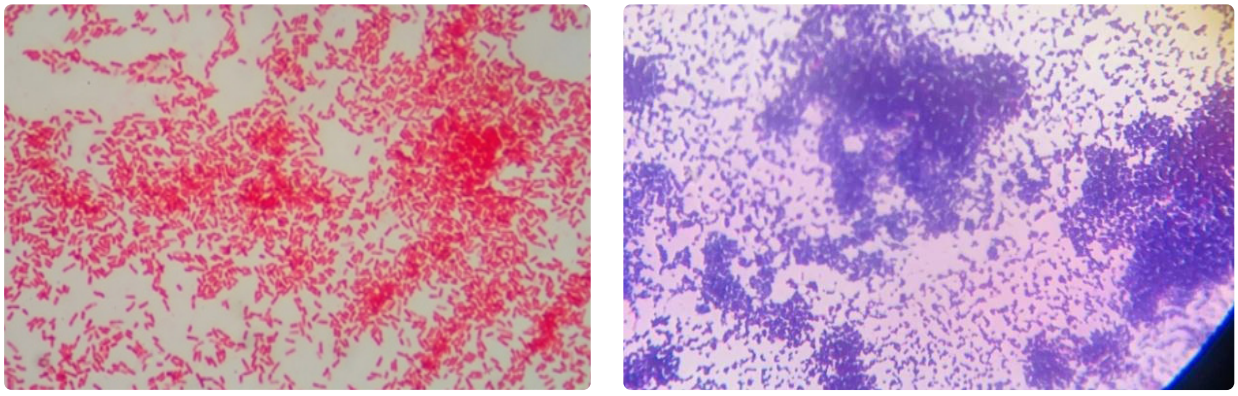


Figure 1. Bacterial species are studied and grown in different culture media

Microscopic Identification

Microscopic examination of the recovered isolates was carried out using Gram staining to determine cell morphology and Gram reaction .The results demonstrated that *Staphylococcus lentus* appeared as Gram-positive cocci arranged predominantly in irregular clusters .*Enterococcus gallinarum* was observed as Gram-positive ovoid cocci occurring in pairs and short chains .*Rothia kristinae* also exhibited Gram-positive cocci arranged in irregular clusters or short chains.In contrast ,the isolates of *Aeromonas salmonicida* ,*Klebsiella oxytoca* . appeared as Gram-negative bacilli (rods). *Bacillus cereus* was identified as large ,Gram-positive, spore-forming bacilli arranged singly or in short chains .These microscopic

findings were consistent with the colonial morphology and growth patterns observed on selective and differential culture media ,providing confirmatory evidence for the primary identification of these isolates[10] .



B A

Figure 3. shows the microscopic shape of bacterial colonies
A -positive B -negative for Gram stain

Biochemical Identification

To confirm the identity of the bacterial isolates ,a set of standard biochemical tests were performed ,including the IMViC test (Indole ,Methyl Red, Voges-Proskauer ,Citrate) , as well as catalase ,oxidase ,motility ,and urease tests .The results were as follows:

1-**CatalaseTest**

Staphylococcus aureus ,Rothia kristinae ,Aeromonas salmonicida ,Klebsiella oxytoca and *Bacillus* spp .showed catalase positivity by producing bubbles due to the enzymatic breakdown of hydrogen peroxide (H_2O_2)into water and oxygen. This enzymatic activity serves as a primary defense mechanism against oxidative stress [9] In contrast ,*Enterococcus gallinarum* lacks the catalase enzyme and thus tested catalase negative.

2-OxidaseTest

Aeromonas salmonicida tested positive due to the presence of cytochrome c oxidase ,which catalyzes the oxidation of tetramethyl-p-phenylenediamine to a purple-colored compound. E*nterococcus gallinarum ,Staphylococcus lentus ,Rothia kristinae ,Klebsiella oxytoca* ,and *Bacillus cereus* were oxidase negative ,reflecting the ab-

sence of cytochrome c oxidase in their electron transport chains[11] .

3-MotilityTest

Aeromonas salmonicida ,and *Bacillus cereus* exhibited motility enabled by peritrichous flagella that facilitate active.movement [12] .*Staphylococcus lentus* ,*Enterococcus gallinarum, Klebsiella oxytoca* (capsulated and non-mtile), and *Rothia kristinae* were non-motile.

4-Urease Test

Klebsiella oxytoca were urease positive due to rapid hydrolysis of urea into ammonia ,which raises the pH and changes the medium color to pink. *Staphylococcus lentus* ,*Enterococcus gallinarum* ,*Rothia kristinae* ,,*Aeromonas salmonicida* ,and *Bacillus* spp. were urease negative due to the absence of urease enzyme ,resulting in a negative reaction[13] .

5-IMViC Tests

Klebsiella oxytoca :Indole,(+) Methyl Red ,(-) Voges-Proskauer,(+) Citrate ,(+) indicating citrate utilization ,production of neutral end products such as acetoin ,and tryptophan hydrolysis .*Aeromonas salmonicida* :Generally oxidase positive ,indole variable, citrate positive ,consistent with its facultative metabolism[14] .

Table 2.Biochemical tests used in the study

The Test	Gram Posetiv Bacteria	Gram Negetiv Bacteria
Catalase	*Staphylococcus aureus* ,*Rothia kristinae* ,*Aeromonas salmonicida*, *Klebsiella oxytoca* ,*Bacillus spp.*	*Enterococcus gallinarum*
Oxidase	*Aeromonas salmonicida*	*Enterococcus gallinarum* ,*Staphylococcus lentus* ,*Rothia kristinae* ,*Klebsiella oxytoca* ,.,*Bacillus cereus*
Motility	,*Aeromonas salmonicida* ,*Bacillus cereus*	*Staphylococcus lentus* ,*Enterococcus gallinarum* ,*Klebsiella oxytoca* ,*Rothia kristinae*
Urease	*Klebsiella oxytoca*	*Staphylococcus lentus* ,*Enterococcus gallinarum* ,*Rothia kristinae* , *Aeromonas salmonicida* ,*Bacillus spp.*
IMViC	*Klebsiella oxytoca* :Indole,(+) Methyl Red ,(-) Voges-Proskauer ,(+)Citrate ;(+) *Aeromonas salmonicida* :Indole variable ,citrate (+)	—

Sensitivity and resistance of bacterial species to antibiotics

In this study ,all bacterial isolates were tested against 12 commonly used antibiotics ,including Meropenem, Imipenem ,Gentamicin ,Amikacin, Ceftazidime ,Clindamycin ,Erythromycin ,Penicillin ,Amoxicillin ,and Metronidazole.

*Carbapenems (*Meropenem and Imipenem*) act by binding to penicillin-binding proteins (PBPs*), inhibiting bacterial cell wall synthesis and inducing cell death .Aminoglycosides)Gentamicin and Amikacin (inhibit protein synthesis by binding to the 30S ribosomal subunit .Therefore, these antibiotic classes were expected to show high efficacy across most isolates ,while other classes such as cephalosporins and macrolides may exhibit variable activity depending on intrinsic and acquired resistance mechanisms.

Rothia kristinae isolates exhibited high susceptibility to carbapenems (Meropenem 33 mm ,Imipenem28 mm) ,moderate to high susceptibility to aminoglycosides (Gentamicin26 mm ,Amikacin 20 mm), and low or no susceptibility to Ceftazidime13) mm) , Metronidazole (9 mm) , Penicillin ,Clindamycin ,and Erythromycin .These results are consistent with previous reports [18–15] and reinforce the preference for carbapenems and aminoglycosides in managing Rothia infections.

Similarly ,*Staphylococcus lentus* showed high susceptibility to carbapenems (Meropenem 32 mm ,Imipenem 28mm) , good susceptibility to aminoglycosides (Gentamicin 24 mm ,Amikacin 21 mm) , and intermediate susceptibility to Ceftazidime (16 mm), with no susceptibility to Penicillin ,Clindamycin ,Erythromycin ,and Metronidazole.[25–19]

Enterococcus gallinarum demonstrated high susceptibility to carbapenems (Meropenem 31 mm ,Imipenem 32mm) , good susceptibility to aminoglycosides (Gentamicin 27 mm ,Amikacin 24 mm) , moderate susceptibility to Erythromycin (27 mm) , Clindamycin 25) mm ,(Penicillin 11) mm ,(and Amoxicillin (9 mm), and no susceptibility to Ceftazidime and Metronidazole.

Aeromonas salmonicida showed high susceptibility to carbapenems

(Meropenem 34 mm ,Imipenem43 mm), moderate to good susceptibility to aminoglycosides (Gentamicin 22mm ,Amikacin 19 mm), moderate susceptibility to Penicillin (24 mm), Ceftazidime (23 mm), Amoxicillin (12mm), and low or no susceptibility to Metronidazole ,Clindamycin ,and Erythromycin.

Bacillus cereus isolates were highly susceptible to carbapenems (Meropenem 40 mm ,Imipenem 47 mm),good susceptibility to aminoglycosides (Gentamicin 28 mm ,Amikacin 25 mm), moderate susceptibility to Penicillin (16 mm), Clindamycin (15mm), Metronidazole 16) mm ,(low susceptibility to Ceftazidime (8 mm), and no susceptibility to Erythromycin.

Klebsiella oxytoca exhibited good susceptibility to carbapenems) Meropenem 28 mm ,Imipenem 28 mm,(moderate susceptibility to Gentamicin (23mm), Amikacin (22 mm), Clindamycin (32 mm)Erythromycin (15 mm) ,and no susceptibility to Amoxicillin, Penicillin ,Metronidazole ,and Ceftazidime.[15,18,25]

The antimicrobial susceptibility results in this study showed that all bacterial isolates were highly sensitive to the carbapenem group (Meropenem and Imipenem), which is consistent with numerous reports indicating that this class of antibiotics remains effective against most bacteria resistant to other groups ,due to its potent mechanism of inhibiting bacterial cell wall synthesis [26] The results also demonstrated good efficacy of aminoglycosides (Gentamicin and Amikacin) against most isolates ,reinforcing their importance as an adjunct or alternative therapeutic option ,particularly in severe or mixed infections .In contrast, a marked variability in susceptibility was observed toward other classes such as cephalosporins (Ceftazidime), macrolides (Erythromycin), and lincosamides (Clindamycin), which can be attributed to acquired resistance mechanisms such as β-lactamase production or active efflux pumps[27] The reduced or absent efficacy of commonly used antibiotics like penicillin and amoxicillin reflects the widespread prevalence of resistance genes in both oral and environmental bacteria ,further complicating treatment strategies [28]*Rothia kristinae* and *Staphylococ-*

Table 3.shows the results of the sensitive antibiotics of the isolated bacterial species.

(italic) Bacteria	Meropenem	Imipenem	Gentamicin	Amikacin	Ceftazidime	Clindamycin	Erythromycin	Penicillin	Amoxicillin	Metronidazole
kristinae Rothia	33	28	26	20	13	0	0	0	0	9
lentus Staphylococcus	32	28	24	21	16	0	0	0	0	0
gallinarum Enterococcus	31	32	27	24	0	25	27	11	9	0
salmonicida Aeromonas	34	43	22	19	23	0	0	24	12	13
cereus Bacillus	40	47	28	25	8	15	0	16	0	16
oxytoca Klebsiella	28	28	23	22	0	32	15	0	0	0

cus lentus exhibited similar resistance profiles ,with high susceptibility to carbapenems and aminoglycosides, supporting their use as first-line therapy when necessary .*Enterococcus gallinarum* also showed good susceptibility to macrolides and lincosamides, potentially offering additional options when carbapenems are unavailable or contraindicated .In the case of Aeromonas salmonicida ,the results align with reports indicating relatively high susceptibility to carbapenems and aminoglycosides ,with notable resistance to metronidazole ,which is expected given its primary activity against anaerobes .*Bacillus cereus* demonstrated the highest inhibition zone diameters with carbapenems ,reflecting the rarity of resistance to this group so far ,while showing near-complete resistance to erythromycin .Conversely ,*Klebsiella oxytoca* exhibited broad resistance to penicillin ,amoxicillin ,and ceftazidime ,which is consistent with its known possession of extended-spectrum β-lactamases.

Conclusions

This study demonstrated the polymicrobial nature of oral infections, including gingivitis and dental caries, with *Staphylococcus lentus* and *Enterococcus gallinarum* being the predominant isolated species.

The results confirmed notable differences in antibiotic susceptibility among the bacterial isolates Carbapenems and aminoglycosides exhibited consistently high efficacy ,whereas traditional antibiotics such as penicillin ,erythromycin ,and metronidazole showed high resistance rates.

These findings underscore the necessity of performing antibiotic susceptibility testing prior to treatment and the importance of evidence-based selection of antimicrobials .In addition ,enhancing oral hygiene practices and incorporating molecular diagnostic techniques are essential strategies for early detection and effective management of oral infections.

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