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Exploring the Incidence of *Enterococcus faecalis* in some Clinical Specimens

Shurooq Sabah Hussien*, Alyaa R.Hussein
Department of Biology, College of Science, University of Baghdad, Baghdad, Iraq

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Abstract

Enterococci are a significant cause of hospital-acquired infections and have emerged as a global public health issue. This study aimed to assess the prevalence and characteristics of *Enterococcus faecalis* in local clinical samples, as well as to examine their biofilm-forming potential and antibiotic susceptibility profiles. Samples were collected from Medical City Hospitals in Baghdad city from November 2023 to February 2024. *E. faecalis* bacterium was isolated and identified from 120 clinical samples (tooth canal, blood, tissue and urine samples) through biochemical tests, with confirmation using Vitek 2 system. The total percentage of isolation for *E. faecalis* was 54.16% where 16.7% of tooth root canal and 50% of urine samples were *E. faecalis* positive. A total of 65 *E. faecalis* isolates were then studied for their capability to form biofilm using the microtiter plate method. The percentage of biofilm formation among *E. faecalis* clinical isolates was 1.5% non-adherent, 29.2% weak, 67.7 % moderate, and 1.5% strong. Antibiotic sensitivity testing of *E. faecalis* isolates from clinical samples was conducted using VITEK 2 compact system, the results showed that 100% of the isolates were resistant to Erythromycine and (95%) of the isolates were resistant to Tetracyclin, and Linezolid, while 95.40% of *E. faecalis* isolates were sensitive to tigecycline. showed that *E. faecalis* scored highest resistance toward erythromycin (100%) followed by tetracyclin (95.4%) compared to other antibiotics with significant differences ($p<0.05$). Additionally, present findings showed *E. faecalis* scored the highest sensitivity to tigecyclin (95.4%), followed by nitrofurantoin (92.3%), levofloxacin (92.3%), and then linezolid (64.6%) compared to other antibiotics with significant different ($p<0.05$). The biofilm production assay showed that most *E. faecalis* isolates produce weak and moderate biofilm (29.2% and 67.7%) respectively, and most of these bacteria were isolated from urine (80.0%) with significant differences ($p<0.05$) and isolated from root and tissue produce moderate biofilm (87.5% and 100%) with significant difference ($p<0.05$). In conclusion, our results indicate a high prevalence of *E. faecalis* contamination in local clinical samples, with varying abilities to produce biofilms and highlight distinct profiles for antibiotic susceptibility among the isolates.

Key words: *E. faecalis*, Biofilm production, Clinical samples and Antibiotics sensitivity

استكشاف انتشار بكتريا المكورات المعوية البرازية في بعض العينات السريرية

شروق صباح حسين ، علياء رزوقي حسين
قسم علوم الحياة، كلية العلوم ، جامعه بغداد، بغداد، العراق

*Email: Sherouk.Sabah2302@sc.uobaghdad.edu.iq

الخلاصة:

تعتبر المكورات المعوية سببًا مهمًا للعدوى المكتسبة من المستشفيات وقد ظهرت كمشكلة صحية عامة عالمية. هدفت هذه الدراسة إلى تقييم انتشار وخصائص المكورات المعوية البرازية في العينات السريرية المحلية، وكذلك فحص قدرتها على تكوين الأغشية الحيوية وملامح حساسية المضادات الحيوية. تم جمع العينات من مستشفيات مدينة الطب في مدينة بغداد من نوفمبر 2023 إلى فبراير 2024. تم عزل وتحديد بكتيريا *E. faecalis*من 120 عينة سريرية (عينات قناة الأسنان والدم والأنسجة والبول) من خلال الاختبارات البيوكيميائية، مع التأكيد باستخدام نظام Vitek 2. كانت النسبة المئوية الإجمالية لعزل *E. faecalis* 54.16٪ حيث كانت 16.7٪ من قناة جذر الأسنان و 50٪ من عينات البول إيجابية لـ *E. faecalis*. ثم تمت دراسة ما مجموعه 65 عزلة من *E. faecalis* لقدرتها على تكوين الأغشية الحيوية باستخدام طريقة لوحة الميكروتيتر. كانت نسبة تكوين الأغشية الحيوية بين العزلات السريرية لـ *E. faecalis* 1.5٪ غير ملتصقة، 29.2٪ ضعيفة، 67.7٪ معتدلة، و 1.5٪ قوية. تم إجراء اختبار حساسية المضادات الحيوية لعزلات *E. faecalis* من العينات السريرية باستخدام نظام VITEK 2 compact ، وأظهرت النتائج أن 100٪ من العزلات كانت مقاومة للإريثروميسين و (95٪) من العزلات كانت مقاومة للتتراسيكلين، ولاينزوليد، في حين أن 95.40٪ من عزلات *E. faecalis*كانت حساسة للتيغيسيكلين. أظهرت أن *E. faecalis* سجلت أعلى مقاومة للإريثروميسين (100٪) يليه التتراسيكلين (95.4٪) مقارنة بالمضادات الحيوية الأخرى مع اختلافات كبيرة ($p < 0.05$). بالإضافة إلى ذلك، أظهرت النتائج الحالية أن *E. faecalis* سجلت أعلى حساسية لتيجيسيكلين (95.4٪)، تليها نتروفورانتوين (92.3٪)، وليفوفلوكساسين (92.3٪)، ثم لينزوليد (64.6٪) مقارنة بالمضادات الحيوية الأخرى مع اختلاف كبير (ص <0.05). أظهر اختبار إنتاج الأغشية الحيوية أن معظم عزلات *E. faecalis* تنتج أغشية حيوية ضعيفة ومتوسطة (29.2٪ و 67.7٪) على التوالي، وتم عزل معظم هذه البكتيريا من البول (80.0٪) مع اختلافات كبيرة (ص <0.05) والمعزولة من الجذر والأنسجة تنتج أغشية حيوية معتدلة (87.5٪ و 100٪) مع اختلاف كبير (ص <0.05). وفي الختام، تشير نتائجنا إلى انتشار كبير لتلوث *E. faecalis* في العينات السريرية المحلية، مع قدرات متفاوتة لإنتاج الأغشية الحيوية، وتسليط الضوء على ملفات تعريف مميزة لحساسية المضادات الحيوية بين العزلات.

1. Introduction

Enterococci, a type of lactic acid bacteria, are a highly diverse and species-rich group that can be found in a wide range of environments. These environments include water [1, 2], sewage [3], soil [4], and arable land [5]. Additionally, enterococci are found on wild plants [6] and have been isolated from plants like olives [7]. Certain species of enterococci play a significant role in maintaining intestinal homeostasis, are commensal, and have the ability to activate the immune system [8]. Enterococci typically inhabit the human intestine. They are commensal microorganisms, but antibiotic resistance has caused them to become important hospital-acquired infections over the last 20 years [9]. Enterococci are natural commensals in humans' gastrointestinal tracts, mouth cavities, and vaginas. They can cause a wide range of infections in humans, infecting the urinary system, bloodstream, endocardium, abdomen, biliary tract, burns and wounds [10]. Attention to enterococci is crucial due to their resistance to medications, which contributes to the high rates of spread of infection cases and then the great resistance to it from the known cases of recovery. These include microlides, aminoglycosides, and sulfametocasole Biofilm-forming bacteria are responsible for about 65% of nosocomial infections and 80% of bacterial infections, making them a major issue in the field of urology [11].

This research focuses on enterococci, which are recognized uropathogens and facultative anaerobic commensal organisms of the gastrointestinal tract that are Gram-positive. From endocarditis to UTIs, *Enterococcus* species are becoming a major source of infections linked

to healthcare [12]. Enterococcal infections are particularly noteworthy due to their capacity to proliferate in harsh conditions and their inherent multidrug resistance, which present a distinct challenge [13].

In both veterinary and human medicine, hospital-acquired infections are associated with increased rates of mortality and morbidity. They also impose a financial burden since they raise the expense of prolonged hospital stays and treatment options [14, 15] Surgical wounds, UTIs, and gastrointestinal infections account for the majority of reported [15] and bacteria like *Enterococcus* species (spp.). In fact, infections of the urinary tract are the second most common type of infection in the body.

These bacteria are known to be an opportunistic pathogen that can cause intestinal illnesses and infective endocarditis. It can also release an exogenous toxin called cytolysin, which lyses eukaryotic cells and bacteria [16]**.** These bacteria inhabit the genitourinary tract and digestive system of humans. Some strains are stable, making them useful as probiotics because they can produce certain vitamins and other important elements in the intestines during the digestive process [17].
E. faecalis is a well-studied biological indicator. Numerous laboratory experiments examining *E. faecalis's* susceptibility to endodontic therapy revealed the bacteria's strong tolerance to antimicrobial treatments. Additionally, *E. faecalis* can survive in extremely unforgiving conditions with a low food supply and a high alkaline pH of up to 11.5. The ability of *E. faecalis* to develop as a mono-infection in treated canals and as a biofilm on root canal walls without the synergistic support of other bacteria renders the pathogen highly resistant to antimicrobial agents and root canal therapy [18]**.** Enterococci are bacteria that inhabit the gastrointestinal tracts of both humans and animals, representing a significant global cause of nosocomial infections. Biofilm development is an alternative lifestyle in which bacteria adapt to multicellular activity to facilitate and prolong survival in a variety of environmental environments. Enterococcus species generate biofilms on biotic and abiotic surfaces in both natural and therapeutic environments. One of Enterococcus' most notable virulence traits is its capacity to produce biofilms [19]. Virulence factors play a role in pathogenesis by mediating adherence colonization and invasion into host tissues, and the production of toxin and enzymes, all of which can increase the severity of infection [20].
One of the primary pathogenic characteristics of Enterococci is their ability to produce biofilms [21]. Biofilms shield the bacteria from phagocytosis, antibiotics, and host immune responses [22] Several Enterococcal virulence factors, including adhesions and secreted factors, have been linked to the production of biofilms [23].

The current study aimed to evaluate the presence of *E. faecalis* in various clinical samples and study their ability to form or produce biofilm and the antibiotics susceptibility profile was also studied.

2. Materials and Methods:

2.1 Isolation:

From October 2023 to January 2024, a total of 120 clinical samples were collected from patients at several hospitals in Baghdad, specifically Ghazi Al-Hariri Hospital for surgical Specialties and Kadhimiya Teaching Hospital. The samples included 60 urines,20 from each root canal, blood, and tissue. All samples were cultured on Pfizer selective Enterococcus agar and incubated anaerobically at 37°C for 18-24 hrs. This study was approved by the Ethical Committee, Department of Biology, College of Science, University of Bagdad and the Iraqi

Ministry of Health, Baghdad, Iraq under the reference number CSEC/1023/0093 in 29th October 2023.

2.2 Bacterial Identification

- **Microscopic examination**: Isolates were subjected to Gram stain and then examined under the light microscope.
- **Identification using biochemical tests:** Biochemical techniques such as the catalase test, growth in 6.5% NaCl, growth at 10° and 45°C, and growth in a pH value of 9.6 were used to identify bacterial isolates manually.
- **Identification using VITEK 2 system:** The outcomes were confirmed using the VITEK 2 System. The isolates were cultured on Pfizer selective Enterococcus agar, after which they were refined and pure colonies were created by anaerobic 24-hour incubation at 37°C. The VITEK kit was then filled with the samples, which were suspended cells in 5 mL of normal saline. Check the outcome after five to seven hours.

2.3 Antimicrobial Susceptibility Testing:

E.faecalis patterns of antibiotic resistance were investigated utilizing (VITIKE 2) compact system. Antibiotics such as vancomycin (VAN), Nitrofurantoin, Teicoplanin, Tetracycline, Tigecycline, Linezolid, Levofloxacin, and Erythromycin were tried against *E.faecalis* isolates, by Clinical and Laboratory Standards Institute's guidelines [24].

2.4 Biofilm formation:

An assay for biofilm development was investigated using the microtiter plate method. Initially, all polystyrene microtiter plate (Becton Dickinson and Co.) wells were filled with 200 µl of fresh Trypticase Soy Broth with 1% glucose as an addition (TSB, Merck, Germany) . Following this, 20 µl of TSB containing a 24-hour bacterial culture was added, and the mixture was incubated for 24 hours at 37 °C. After three rounds of washing with phosphate-buffered saline (PBS, Sigma®, USA) and fixing in 95% methanol for 20 minutes, each well received 200 µl of crystal violet (1%) and three rounds of sterilized distilled water washing to remove any leftover crystal violet. Finally, each well was treated with 200 µl of methanol (80/20%), and the OD at 570 nm was read using an ELISA Reader (Bio-Rad, model 658, USA) Figure 1 [25].

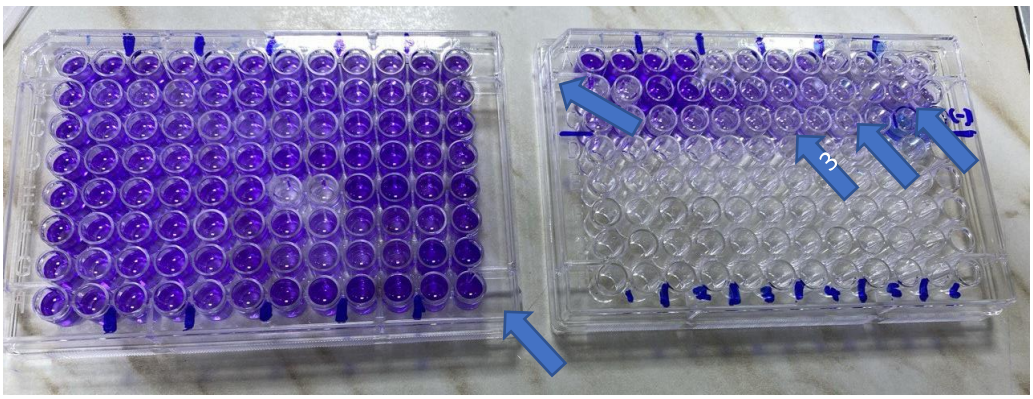

Figure 1: Biofilm formation according to blue arrows (1- control, 2- weak, 3- non-adherent, 4- moderate, 5- strong)

2.5 Statistical analysis

All features were presented as frequencies, and the Pearson-Chi-square test was utilized to reveal significant differences in percentages. P≤0.05 was measured as significant. Raw data were analyzed using SPSS v. 23.0 statistical software.

3. Results

The percentage of *E. faecalis* isolation was 54.16% from 120 clinical local samples, while 45.84% showed negative growth on the selective medium. Biochemical techniques, including the catalase test, growth in 6.5% NaCl, growth at 10° and 45°C, and growth in a pH value of 9.6 were used to manually identify bacterial isolates.

Figure (2) shows the growth of *E.faecalis* on a selective medium that appears as black colonies.

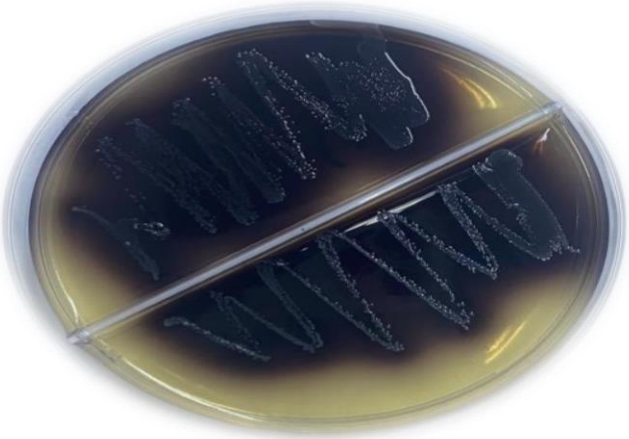

Figure 2: Identification of *E. faecalis on* pfizer selective Enterococcus agar

Table 1: shows the identification chart of bacteria using Vitek 2 system tests.

Organism Quantity:

Selected Organism : Enterococcus faecalis

Source: **Collected:**

Comments:	

Identification Information	**Analysis Time:**	2.68 hours	**Status:** Final
Selected Organism	99% Probability	**Enterococcus faecalis**	
	Bionumber:	156002661753431	
ID Analysis Messages			

Biochemical Details																	
2	AMY	+	4	PIPLC	-	5	dXYL	-	8	ADH1	+	9	BGAL	-	11	AGLU	+
13	APPA	-	14	CDEX	+	15	AspA	+	16	BGAR	-	17	AMAN	-	19	PHOS	-
20	LeuA	-	23	ProA	-	24	BGURr	-	25	AGAL	-	26	PyrA	+	27	BGUR	-
28	AlaA	-	29	TyrA	+	30	dSOR	+	31	URE	-	32	POLYB	+	37	dGAL	+
38	dRIB	+	39	ILATk	-	42	LAC	-	44	NAG	+	45	dMAL	+	46	BACI	+
47	NOVO	+	50	NC6.5	-	52	dMAN	+	53	dMNE	+	54	MBdG	+	56	PUL	-
57	dRAF	-	58	O129R	-	59	SAL	+	60	SAC	+	62	dTRE	+	63	ADH2s	-
64	OPTO	+															

Based on sample sources, present findings showed that most samples were taken from urine (50.0%), followed by blood (16.7%), tissue (16.7%) and tooth root canal (16.7%) as shown in table 2.

Table 2: Percentages of bacterial growth and samples sources

		Count	Percent
Bacterial growth	*Enterococcus faecalis*	65	54.16%
	Negative	55	45.84%
Samples sources	Tooth root canal	20	16.7%
	Tissue	20	16.7%
	Blood	20	16.7%
	Urine	60	50.0%

Data of the current study indicated that the urine samples had the highest percentage among the total samples 120 (50%) and among *Enterococcus faecalis* isolates (80%) compared to other samples with significant differences ($p<0.05$) as shown in table 3.

Table 3: The Isolation Percentage of *Enterococcus faecalis* from Specimens

Specimen Type	Specimen No.	Isolate No.	Percentage of isolation from 65 Isolates %	Percentage of isolation from 120 Specimen %
Urine	**60**	**52**	**80%**	**50%**
Root Canal	**20**	**8**	**12.4%**	**16.7%**
Blood	**20**	**4**	**6.1%**	**16.7%**
Tissue	**20**	**1**	**1.5%**	**16.7%**
Total	**120**	**65**	**100%**	**100%**
P value			*P<0.001***	*P<0.01***

Results of the present study in biofilm production assay showed that most *Enterococcus faecalis* isolates produced weak and moderate biofilm, with percentages of 29.2% and 67.7%, respectively, and most of these bacteria were isolated from urine (80.0%) with significant differences ($p<0.05$), as presented in Table 4.

Table 4: Frequencies and percentages of biofilm formation of *Enterococcus faecalis*

Category		Count	Percent	P value
Biofilm	Non-adherent	1	1.5%	p<0.001***
	Weak	19	29.2%	
	moderate	44	67.7%	
	Strong	1	1.5%	

Based on biofilm, present research showed the most *Enterococcus faecalis* isolated from root and tissue produce moderate biofilm (87.5% and 100%) with significant difference ($p<0.05$) (table 5).

Table 5: Biofilm formation in comparison to sample sources of *E. feacalis* isolates

Category			Root	tissue	blood	urine	total	P value
Biofilm	Non-adherent	n	0	0	0	1	1	1.00
		%	0.0%	0.0%	0.0%	1.9%	1.5%	
	Weak	n	1	0	1	17	19	p<0.01**
		%	12.5%	0.0%	25.0%	32.7%	29.2%	
	Moderate	n	7	1	3	33	44	p<0.01**
		%	87.5%	100.0%	75.0%	63.5%	67.7%	
	Strong	n	0	0	0	1	1	1.00
		%	0.0%	0.0%	0.0%	1.9%	1.5%	
P value			p<0.01**	1.00	p<0.01**	P<0.05*	p<0.01**	

The results of the present study in antibiotics susceptibility test showed that *Enterococcus faecalis* exhibited the highest resistance toward erythromycin (100%) followed by tetracyclin

(95.4%) compared to other antibiotics with significant differences ($p<0.05$). Conversely, present findings showed *Enterococcus faecalis* scored the highest sensitivity to tigecyclin (95.4%), followed by nitrofurantoin (92.3%), levofloxacin (92.3%), and then linezolid (64.6%) compared to other antibiotics with significantly different ($p<0.05$) (table 6) and (Figure 3).

Table 6: Antibiotic Sensitivity of E. faecalis using Vitek 2 compact system

Organism Quantity:
Selected Organism : Enterococcus faecalis

Source: **Collected:**

Comments:	TIGECYCLINE: The ability of the AST card to detect resistance with this combination is unknown because resistant strains were not available at the time of comparative testing. LINEZOLID: The ability of the AST card to detect resistance with this combination is unknown because resistant strains were not available at the time of comparative testing.

Susceptibility Information	**Analysis Time:** 17.37 hours	**Status:** Final

Antimicrobial	MIC	Interpretation	Antimicrobial	MIC	Interpretation
Cefoxitin Screen			Teicoplanin	>= 32	R
Benzylpenicillin			Vancomycin	>= 32	R
Oxacillin			Tetracycline	>= 16	R
Gentamicin			#Tigecycline	1	
Tobramycin			Fosfomycin		
Levofloxacin	1	S	Nitrofurantoin	128	R
Moxifloxacin			Fusidic Acid		
Inducible Clindamycin Resistance			Mupirocin		
Erythromycin	>= 8	R	Rifampicin		
Clindamycin			Trimethoprim/ Sulfamethoxazole		
#Linezolid	>= 8	R			

#= Disabled bioART Limitation Rule

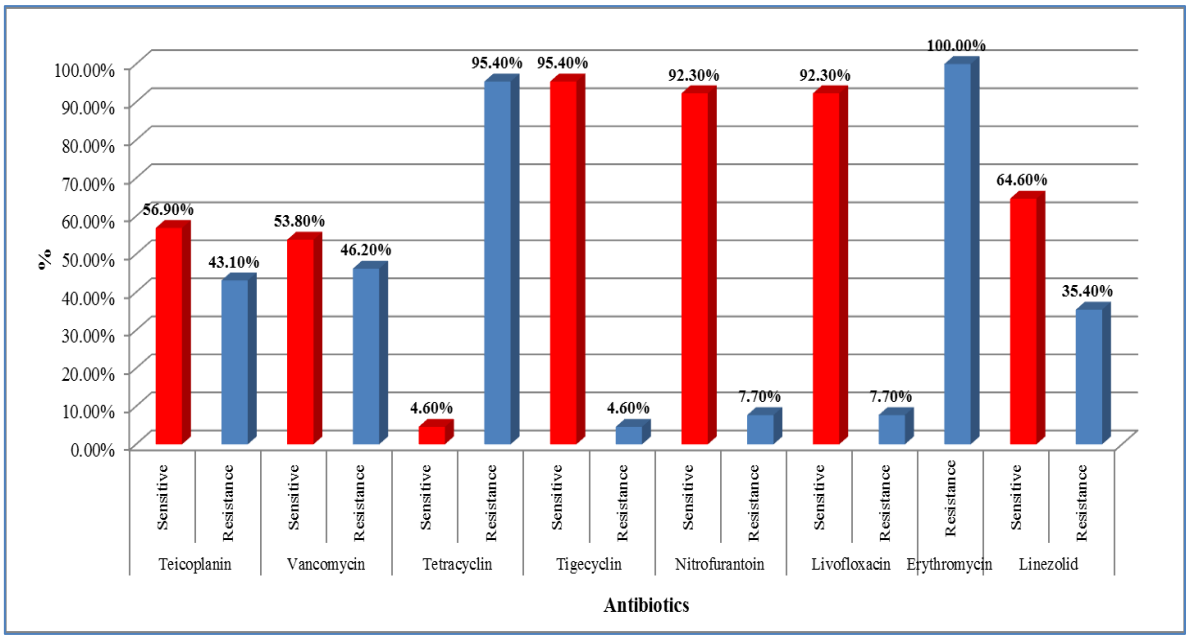

Figure 3: Frequency and percentage of sensitivity (red color) and resistance (blue color) of antibiotics against *Enterococcus faecalis* isolated from many sources

4. DISCUSSION

Out of 120 specimens, *E. faecalis* was isolated in 54.16% of the cases, while 45.84% showed negative growth with non-significant differences ($p>0.05$) between positive and negative growth. The percentages of *Enterococcus spp*. isolates from urine were 80%, which was consistent with a local study [20] which found 46.6% isolates of *Enterococcus* spp. in urine samples, and more than the other study, which found 40.32% isolates of Enterococcus spp. A recent local study indicated an overall percentage of isolates for Enterococcus spp. was 44.6%; *E. faecalis* accounted for 76% of the isolates [26]. Additionally, another study found that (46.87%) of isolates from urine [27]. The results of this study showed in addition to the results of previous studies, the largest proportion of *E. faecalis* isolates is present in urine, especially in women, which is higher than in men, which indicates that *Enterococcus spp* is a major and dangerous cause of urinary tract infections. It is certain that the biofilm generated by enterococci adheres to epithelial cells in the sewage. Urinary tract infection is strongly associated with *E. faecalis* [28]. In addition to other virulence factors that it possesses, it helps it penetrate the cell. Including toxins and other antigens found inside the bacterial cell [29]. During this study, 65 clinical isolates of enterococci were collected from various sources, and their type was determined at the species level. Most of the isolates were *E. faecalis*. Other cases similar to the infection appeared in Egypt [30] and other countries [31], where the number of enterococci isolates reached (4954), sample 90, representing 1.8% of the infection rate. 53 (58.9%) came from urine, 16 (17.8%) from blood, 14 (15.5%) from wounds and 4 from tissues. And two other body fluids. In various clinical settings, 50 (55%) were isolated from female patients and 40 (45%) from male patients. *E. faecalis* (n=63), *E. faecium* (n=25), and *Enterococcus gallinarum* (n=2) were isolated from the samples reported earlier [32]. Our results did not correlate with their findings regarding isolation rate.

Enterococci that produce biofilms are responsible for persistent, long-term, and antibiotic-resistant infections that can be difficult to treat [33]. In the present study, about (87.5% and 100%) with significant difference ($p<0.05$) *Enterococcus faecalis w*ere biofilm produce weak (29 isolates) and moderate (44 isolates) biofilm producing while *Enterococci* were (9% moderate and 13.6% strong) biofilm producing *Enterococci*, however, 68.1% non-biofilm-formers reported by [34].

The results of the biofilm formation assay indicated that out of 65 isolates moderate biofilm was detected in 44 isolates (67.7%) weak biofilm reaction in 19 isolates (29.2%) and strong biofilm reaction in 1 isolate (1.5%) and non-adherent biofilm reaction in 1 isolate (1.5%).

The majority of the tested *E. faecalis* isolates (87.5% Root and 100% Tissue) in Table 4 were able to create biofilms to varying degrees; just one isolate did not form biofilms. Similar findings on biofilm-forming capacities in *E. faecalis* are available [35]. Following previous studies [21], [36], most of the isolates formed biofilms with either weak or moderate intensity (29.2% and 67.7%) respectively.

Except for one isolate, all of the isolates in this investigation were capable of generating biofilms, and the majority of them could produce weak to moderate biofilms. This finding is comparable to Iranian study, who showed that all *enterococcal* isolates taken from patients with UTI at Okayama University Hospital could form biofilm [37]**.** The increased frequency of biofilm formation is also consistent with previous investigations [38-42] discovered that the biofilm production assay for *E. faecalis* isolates from UTI patients revealed that all of the isolates generated biofilm, albeit with varying intensities. Our findings are somewhat consistent

with their results. They highlighted that, out of the 60 isolates tested for biofilm production, 37 (62%) were capable of forming strong biofilms, 15 (25%) produced moderate biofilms, and 8 (13%) generated weak biofilms. In their investigation, they emphasized that all *E. faecalis* isolates from UTI patients were capable of producing a biofilm, with the majority of them able to create strong to moderate biofilms. Our results are somewhat consistent with their findings. According to the results obtained by Indian study, who demonstrated that seven of the 12 isolates that tested positive for strong biofilm production were urinary isolates, two from wound swabs and blood, and one from tissue [32]. Our recent data differs from their findings in that we obtained only one isolate with strong biofilm formation, while the majority of isolates were moderate or weak biofilm producers. A recent study found every isolate of *E. faecalis* from UTI patients generated biofilm, albeit at varying intensities, according to the biofilm formation assay. Our findings and their outcomes agree in part. They explained that 37 isolates (62%) of the 60 isolates whose ability to produce biofilm was assessed could form strong biofilm; 15 isolates (25%) could form moderate biofilm; and 8 isolates (13%) could form weak biofilm. They made it clear in their study that all of the *E. faecalis* isolates from UTI patients were able to create biofilms, and the majority of them were able to generate strong to moderate biofilms. Our findings are somewhat consistent with theirs [42].

A statistical analysis revealed a substantial link between *Enterococcus* species that produce biofilms and antibiotic impedance to specific antimicrobials (Figure 5). Impedance to numerous antibiotics, including vancomycin (VAN), Nitrofurantoin, Teicoplanin, Tetracycline, Tigecycline, Linezolid, Levofloxacin, and Erythromycin, was considerably higher in high biofilm makers than in mild biofilm creator (Figure 5). The data from the statistical analysis using t-test analysis, as shown in Figure 5, vancomycin resistance (46.2% vs.), Nitrofurantoin impedance (7.7% vs. $p < 0.0001$), Teicoplanin resistance (43.1% vs. Tigecycline resistance (4.6% vs. $p < 0.0001$), and levofloxacin and erythromycin resistance (7.7% vs. 100%, $p < 0.0001$,1.00) [43] investigated the antimicrobial resistance styles of *E. faecalis* strains recovered from hospitalized patients in Shiraz, south-west Iran, and discovered that more than half of the isolates (52.9%) were high-level gentamicin Impedance. Resistance to vancomycin was detected in 45.1% (23/51) of the isolates. Notably, the isolates showed high susceptibility to erythromycin, tetracycline, and ciprofloxacin, with resistance rates of only 3.9%, 5.9%, and 9.8%, respectively. No isolates were found to be resistant to fosfomycin or linezolid. Similarity of this study *Enterococci* isolates showed resistance 100% to Tetracycline, this resistance is achieved by 2 mechanisms: by pumping the antibiotics out of the cell and protecting the ribosome by changing the configuration so this preventing the binding the antibiotics [44]. The results acquired in Iran showed that the frequency of mutable medication resistance among *E. faecalis* stool isolates was 62%, and the majority of isolates were resistance to antibiotics tetracycline (70%), erythromycin (68%), and rifampin (60%) [45]. Another recent Saudi study found that all tested Enterococcus spp. were resistance to all antimicrobials except linezolid and tigecycline [11]. Our data is somewhat compatible with their findings. All biofilm-producing enterococci isolates were shown to be resistant to penicillin, ampicillin, ciprofloxacin, and vancomycin. Two of these isolates were susceptible to nitrofurantoin, linezolid, and high-dose gentamicin. One of the two strong biofilm-producing wound swab isolates was susceptible to both linezolid and vancomycin. Both were susceptible to high dosages of gentamicin. The two blood isolates that formed significant biofilms were susceptible to linezolid and teicoplanin, but impedance to vancomycin, erythromycin, penicillin, and ampicillin[32].

Conclusion

This study found that *E. faecalis* isolated from individuals frequently exhibited antibiotic resistance, particularly to tetracycline and erythromycin. The current investigation emphasizes the importance of adhesion as a key trait that distinguishes enterococcal clinical isolates causing UTI, as the majority of isolates may form a biofilm independent of the source of isolation. Although the intensity of the produced varied amongst isolates, the plurality formed mild to weak biofilms *in vitro*.

Conflict of Interest: "The authors declare that they have no conflicts of interest."

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