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Comparison between Isolates Percentage and Antibiotics Activity of Two Main Species of Pathogenic Gram Negative Bacteria Isolated From Urine Samples

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Abstract:

Seventy five urine samples have been collected through the period from November/2017 to March/2018 for isolation and identification of the two pathogenic gram negative bacteria *Enterobacter* spp. and *Proteus* spp. These bacteria were diagnosed by several types of the biochemical tests. And studied of the comparison between these two bacterial species according to their sensitivity against the antibiotics and percentage of their isolates from urine samples. Some of the antibiotics have activity with significant correlation and differences. The Aztreonam and Novobiocin have highly activity against *Enterobacter* spp. and *Proteus* spp. respectively. Also it was found that the isolates percentage of the *Proteus* spp. was more than the *Enterobacter* spp. in the urine samples which were 13% and 10% respectively.

Key word: Urinary Tract Infetions, *Enterobacter* spp., *Proteus* spp., Antibiotics.

INTRODUCTION

The infections of the urinary tract ranging from simple asymptomatic to difficult symptomatic diseases and this associated with bacteria presence in the urine [1]. This disease type is most commonly caused by the bacteria of the humans in both hospitals and communities conditions [2]. The bacteria of the pathogenic gram negative have ability to causes several types of the nosocomial infections but the *Enterobacter* spp. and *Proteus* spp. play a specific role in this type of the infections [3]. The antibiotics types and working methods as well as the mechanisms of the resistance by different types of the bacteria have been identified in the academic departments until recently in the application of the curative [4]. The aminoglycosides, fluoroquinolones, trimethoprim and b-lactams are most important antibiotics classes which can be used in treatment of the urinary tract infections and have high activity against pathogenic gram negative bacteria [5].

The *Enterobacteriaceae* is the family of the gram negative bacteria which include the *Enterobacter* species, they live as facultative anaerobic rods shapes and no spore formation [6]. These species associated with infections of nosocomial and as urinary tract opportunistic microbes [7]. The most important opportunistic pathogenic species of the *Enterobacter* are including *E. agglomerans*, *E. sakazakii*, *E. gergoviae*, *E.cloacae*, *E. amnigenus*. *E. cancerogenus*, *E. asburiae*, *E. dissolvens* and *E. hormaechei* which these species causes several human infections [8]. Theses bacteria can resistant range of the antibiotics by several mechanisms [6]. The most important resistant mechanisms among *Enterobacter* which is including decrease susceptibility levels of the antibiotics [9].

The family of the *Enterobactericeae* is a gram negative bacteria, wide distrusted in the environment and causes acquired infections of the hospital as well as urinary tract nosocomial infections [10]. The *Proteus* bacteria belong to *Enterobactericeae* and are most common of the urinary tract infections. The *Proteus* is genus of the facultative and aerobic motile gram negative rods, these bacteria are containing several pathogenic species, which are *P. hauser*i, *P. penneri*, *P. vulgaris*, *P. myxofaciens* and *P. mirabilis* [11]. The species of *Proteus* have ability to resistance several type of the antibiotics in the a worldwide [12]. The species of these bacteria that resist more than one type of the antibiotics called multidrug resistant [13].

MATERIALS AND METHODS

The Seventy five urine samples have been collected from patients in sterile container (tube 10 ml) and used for isolation pathogenic gram negative bacteria, the bacterial types that used in this study were *Enterobacter* spp. and *Proteus* spp. These bacteria were diagnosed by growing on several media and by uses the biochemical tests.

Table:1. Identification of the isolated bacteria by the biochemical tests

Biochemical test/ References	*Enterobacter* species [14].	*Proteus* species [15].
Gram stain	Negative	Negative
Indol	Negative	Negative
Urease	Negative	Positive
Oxidase	Negative	Negative
Catalase	Positive	Positive
Citrate	Positive	Positive
Methyl Red	Negative	Positive
Vasik proskor	Positive	Positive
H2S	Negative	Positive

Table (1) results of the biochemical tests were used for diagnosis of the *Enterobacter* species and *Proteus* species, after growing on the Nutrient, Mac Conkey's and Blood agar plates. This identification is according to the Society of the American Bacteriologist [16].

Antibiotic susceptibility test

The Muller Hinton ager plates were used to determine the antibiotics sensitivity of the *Enterobacter* spp. and *Proteus* spp. bacteria. This procedure was done by disc diffusion technique after growing of these bacteria on Muller Hinton ager plats and measuring the antibiotics inhibition zones which were formed after (24 h) by using special scale [17].

Statistical analysis

The result of this study were analyzed through the Statistical Package for Social Science (SPSS) to determine the Mean, Standard Deviation and Standard Error in addition to identify the significant differences between the antibiotic and bacteria by One way Anova through descriptive exclude cases analysis with LSD at 95% confidence and significant level (P-Value=0.05) [18].

RESULTS

Seventy five urine samples have been collect for isolation of the pathogenic gram negative bacteria, these bacteria were *Enterobacter* spp. and *Proteus* spp. And study the antibiotics susceptibility patterns by using of the thirteen type of the antibiotics, the results were illustrated in the following figures and tables.

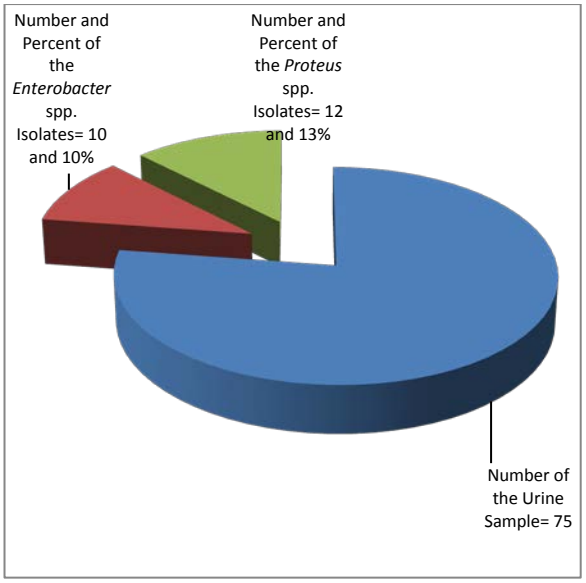

Figure:1. Number and Percentage of the isolated bacteria

Figure (1) the number of the collected urine samples was 75, in addition to the number; percentage of the *Enterobacter* spp. and *Proteus* spp. were 10;10% and 12;13% respectively.

Table (2) the activities of the antibiotics replications measured by millimeter against *Enterobacter* spp. Were the Aztreonam which has high activity with Mean Std. deviation and Std. error equal to 18.2, 3.794 and 1.200 respectively; while the Bacitracin has low activity with Mean Std. deviation and Std. error equal to 3.2, 2.898 and 0.916 respectively.

Table (3) the correlation between antibiotics activity against *Enterobacter* spp. is present between Clindamycin and Trimethoprim; Penicillin-G10 and Oxolinic acid; Penicillin-G10 and Novobiocin; Erythromycin and Amoxicillin; Carbnicillin and Amoxicillin; Amikacin and Amoxicillin. While the other antibiotics have no present correlation. This means, if the antibiotics types have activity with present correlation between them can be used all of the antibiotics types and if no present correlation can be used only the antibiotic type that has activity in treatment of the these bacteria species.

Table:2. Inhibition zones of the antibiotics types against *Enterobacter* spp.

No.	Inhibition zones measured by (mm)			
	Antibiotic types	**Mean**	**Std. Deviation**	**Std. Error**
1	AX 15 µg = Amoxicillin15 µg	7.9	4.483	1.417
2	AK 30 µg = Amikacin30 µg	5.9	4.148	1.311
3	TMP 10 µg = Trimethoprim10 µg	9.7	1.888	0.597
4	ATM 30 µg = Aztreonam30 µg	18.2	3.794	1.200
5	SMZ 25 µg = Sulfamethoxazole25 µg	6.3	3.267	1.033
6	PY 100 µg = Carbnicillin100 µg	4.2	3.794	1.485
7	NV 30 µg = Novobiocin30 µg	6.8	4.391	1.388
8	E 15 µg = Erythromycin15 µg	9.4	2.988	0.945
9	R 40 µg = Rifaximin40 µg	9.3	4.667	1.476
10	P 10 µg = Penicillin-G10 µg	6.3	3.433	1.085
11	OA 2 µg = Oxolinic acid2 µg	7.1	4.433	1.401
12	B 10 µg = Bacitracin10 µg	3.2	2.898	0.916
13	CC 5 µg = Clindamycin5 µg	4.3	3.529	1.116

Table:3. Significant Correlations between the antibiotics types against *Enterobacter* spp.

	CC 5 µg	**B 10 µg**	**OA 2 µg**	**P 10 µg**	**R 40 µg**	**E 15 µg**	**NV 30 µg**	**PY 100 µg**	**SMZ 25 µg**	**ATM 30 µg**	**TMP 10 µg**	**AK 30 µg**	**AX 15 µg**
CC 5 µg		R=.059 Sig=.863	R=.170 Sig=.616	R=-.028- Sig=.936	R=.172 Sig=.613	R=-.230- Sig=.495	R=.374 Sig=.258	R=.329 Sig=.324	R=-.073- Sig=.832	R=.260 Sig=.439	R=-.820-** Sig=.002	R=-.330- Sig=.321	R=-.379- Sig=.250
B 10 µg	R=.059 Sig=.863		R=-.489- Sig=.127	R=-.469- Sig=.146	R=.049 Sig=.886	R=-.070- Sig=.838	R=.190 Sig=.577	R=.287 Sig=.392	R=-.315- Sig=.346	R=.211- Sig=.534	R=-.150- Sig=.660	R=.338 Sig=.310	R=.193 Sig=.569
OA 2 µg	R=.170 Sig=.616	R=.489- Sig=.127		R=.898** Sig=.001	R=-.145- Sig=.671	R=.139 Sig=.684	R=-.507- Sig=.111	R=.38 Sig=.242	R=.051- Sig=.882	R=.024 Sig=.943	R=.291- Sig=.386	R=.401- Sig=.221	R=.006- Sig=.985
P 10 µg	R=.028- Sig=.936	R=.469- Sig=.146	R=.898** Sig=.001		R=-.373- Sig=.258	R=-.098- Sig=.775	R=-.731-* Sig=.011	R=.293 Sig=.382	R=-.187- Sig=.581	R=.187 Sig=.583	R=.055 Sig=.872	R=-.394- Sig=.230	R=.044 Sig=.898
R 40 µg	R=.172 Sig=.613	R=.049 Sig=.886	R=.145- Sig=.671	R=-.373- Sig=.258		R=.579 Sig=.062	R=.215 Sig=.526	R=.109 Sig=.750	R=-.226- Sig=.504	R=.182 Sig=.593	R=.128- Sig=.709	R=.210 Sig=.535	R=.088 Sig=.797
E 15 µg	R=-.230- Sig=.495	R=.070- Sig=.838	R=.139 Sig=.684	R=.098- Sig=.775	R=.579 Sig=.062		R=.259 Sig=.443	R=.387 Sig=.240	R=.101 Sig=.767	R=.428- Sig=.189	R=.040- Sig=.907	R=.563 Sig=.071	R=.603* Sig=.049
NV 30 µg	R=.374 Sig=.258	R=.190 Sig=.577	R=.507- Sig=.111	R=-.731-* Sig=.011	R=.215 Sig=.526	R=.259 Sig=.443		R=.058 Sig=.865	R=.419 Sig=.200	R=.283- Sig=.399	R=.440- Sig=.176	R=.464 Sig=.150	R=.106 Sig=.756
PY 100 µg	R=.329 Sig=.324	R=.287 Sig=.392	R=.385 Sig=.242	R=.293 Sig=.382	R=.109 Sig=.750	R=.387 Sig=.240	R=.058 Sig=.865		R=-.166- Sig=.627	R=.205- Sig=.545	R=.420- Sig=.199	R=.374 Sig=.258	R=.628* Sig=.039
SMZ 25 µg	R=.073- Sig=.832	R=.315- Sig=.346	R=.051- Sig=.882	R=.187- Sig=.581	R=.226- Sig=.504	R=.101 Sig=.767	R=.419 Sig=.200	R=.166- Sig=.627		R=.306- Sig=.359	R=.141- Sig=.680	R=.137 Sig=.687	R=.059 Sig=.862
ATM 30 µg	R=.260 Sig=.439	R=-211- Sig=.534	R=.024 Sig=.943	R=.187 Sig=.583	R=.182 Sig=.593	R=.428- Sig=.189	R=.283- Sig=.399	R=.205- Sig=.545	R=.306- Sig=.359		R=.236 Sig=.485	R=.290- Sig=.388	R=.224- Sig=.509
TMP 10 µg	R=.820-** Sig=.002	R=.150- Sig=.660	R=.291- Sig=.386	R=.055 Sig=.872	R=.128- Sig=.709	R=.040- Sig=.907	R=.440- Sig=.176	R=.420- Sig=.199	R=.141- Sig=.680	R=.236 Sig=.485		R=.235 Sig=.488	R=.265 Sig=.432
AK 30 µg	R=.330- Sig=.321	R=.338 Sig=.310	R=.401- Sig=.221	R=.394- Sig=.230	R=.210 Sig=.535	R=.563 Sig=.071	R=.464 Sig=.150	R=.374 Sig=.258	R=.137 Sig=.687	R=.290- Sig=.388	R=.235 Sig=.488		R=.835** Sig=.001
AX 15 µg	R=-.379 Sig=.250	R=.193 Sig=.569	R=.006- Sig=.985	R=.044 Sig=.898	R=.088 Sig=.797	R=.603* Sig=.049	R=.106 Sig=.756	R=.628* Sig=.039	R=.059 Sig=.862	R=.224- Sig=.509	R=.265 Sig=.432	R=.835** Sig=.001	

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

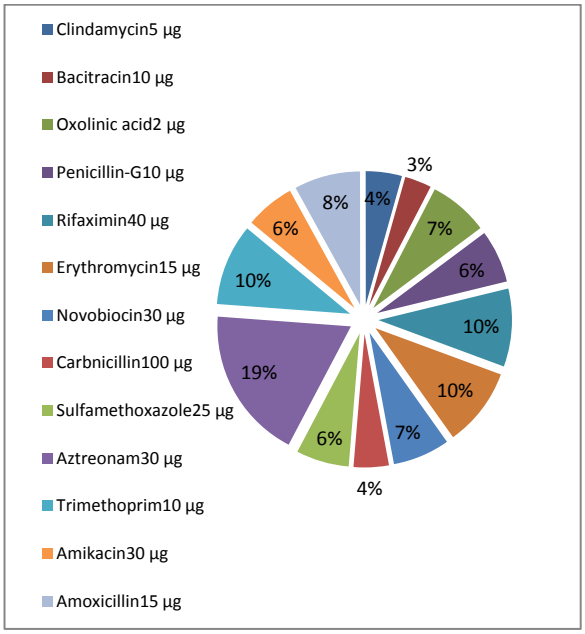

Figure:2. Percentage activity of the antibiotics types against *Enterobacter* spp.

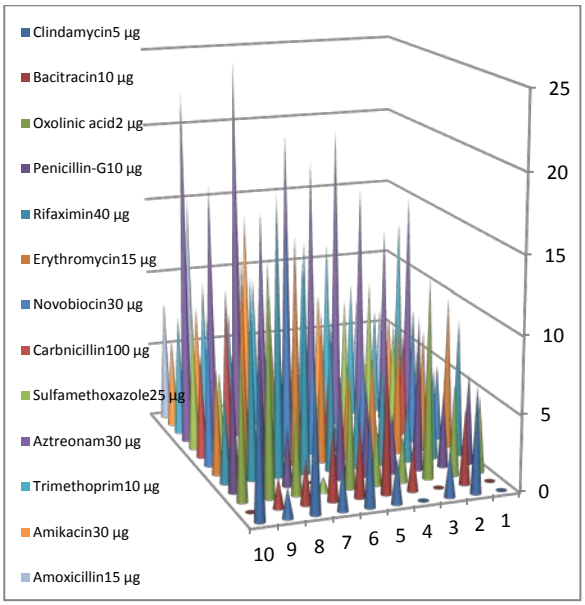

Figure:3. Zone replicates of the antibiotics types against *Enterobacter* spp.

Figure (2) the activity of the antibiotics measured as the percentage, and this showed the Aztreonam has high activity percent equal to (19%) while the Bacitracin has low activity percent equal to (3%) against *Enterobacter* spp. from all antibiotic activities.

Figure (3) types of the antibiotics produced inhibition zones with different sizes when they act as repeaters against *Enterobacter* spp., the Aztreonam has largest inhibition zone equal to (25 mm).

Table (4) the activities of the antibiotics replications measured by millimeter against *Proteus* spp. Were the Novobiocin which has high activity with Mean Std. deviation and Std. error equal to 13.2, 4.391 and 1.388 respectively; while the Penicillin-G has low activity with Mean Std. deviation and Std. error equal to 3.7, 2.540 and 0.803 respectively.

Table (5) the correlation between antibiotic activity against *Proteus* spp. present between Clindamycin and Erythromycin; Oxolinic acid and Amoxicillin; Penicillin-G10 and Novobiocin; Carbnicillin and Amoxicillin; Sulfamethoxazole and Trimethoprim. Whereas the other antibiotics have no present correlation. This means, if the antibiotics types have activity with present correlation between them can be used all of the antibiotics types and if no present correlation can be used only the antibiotic type that has activity in treatment of the these bacteria species.

Table:4. Inhibition zones of the antibiotics types against *Proteus* spp.

No.	Inhibition zones measured by (mm)			
	Antibiotic types	**Mean**	**Std. Deviation**	**Std. Error**
1	AX 15 µg = Amoxicillin15 µg	6.2	3.047	0.963
2	AK 30 µg = Amikacin30 µg	8	2.867	0.906
3	TMP 10 µg = Trimethoprim10 µg	4.9	3.928	1.242
4	ATM 30 µg = Aztreonam30 µg	9.6	5.189	1.641
5	SMZ 25 µg = Sulfamethoxazole25 µg	8.4	5.541	1.752
6	PY 100 µg = Carbnicillin100 µg	6.5	3.308	1.046
7	NV 30 µg = Novobiocin30 µg	13.2	4.391	1.388
8	E 15 µg = Erythromycin15 µg	11.2	3.823	1.209
9	R 40 µg = Rifaximin40 µg	10.9	4.012	1.268
10	P 10 µg = Penicillin-G10 µg	3.7	2.540	0.803
11	OA 2 µg = Oxolinic acid2 µg	7.9	4.605	1.456
12	B 10 µg = Bacitracin10 µg	5.1	3.510	1.110
13	CC 5 µg = Clindamycin5 µg	7.4	2.011	0.635

Table:5. Significant Correlations between the antibiotics types against *Proteus* spp.

	CC 5 µg	B 10 µg	OA 2 µg	P 10 µg	R 40 µg	E 15 µgggg	NV 30 µg	PY 100 µg	SMZ 25 µg	ATM 30 µg	TMP 10 µg	AK 30 µg	AX 15 µg
CC 5 µg		R=.088 Sig=.797	R=.185 Sig=.587	R=-278- Sig=.407	R=-.215 Sig=.526	R=.812** Sig=.002	R=-.086- Sig=.803	R=.050 Sig=.884	R=.054 Sig=.875	R=.123 Sig=.718	R=.582 Sig=.060	R=.116 Sig=.735	R=.131 Sig=.702
B 10 µg	R=.088 Sig=.797		R=.427 Sig=.190	R=-.141 Sig=.680	R=-.102- Sig=.766	R=-.416- Sig=.204	R=-.290- Sig=.387	R=-.244- Sig=.470	R=-.351- Sig=.290	R=-.010- Sig=.977	R=.122 Sig=.722	R=.099 Sig=.771	R=-.012- Sig=.971
OA 2 µg	R=.185 Sig=.587	R=.427 Sig=.190		R=-.050- Sig=.883	R=.426 Sig=.191	R=-.106- Sig=.756	R=-.026- Sig=.939	R=-.492- Sig=.124	R=.037 Sig=.915	R=.393 Sig=.231	R=.073 Sig=.831	R=.379 Sig=.251	R=.706* Sig=.015
P 10 µg	R=-.278- Sig=.407	R=.141 Sig=.680	R=-.050- Sig=.883		R=-.134- Sig=.694	R=-.233- Sig=.490	R=.751-** Sig=.008	R=-.126- Sig=.713	R=.459 Sig=.155	R=.083 Sig=.809	R=.186 Sig=.584	R=-.122- Sig=.721	R=.209 Sig=.536
R 40 µg	R=-.215- Sig=.526	R=-.102- Sig=.766	R=.426 Sig=.191	R=-.134- Sig=.694		R=-.245- Sig=.468	R=.373 Sig=.258	R=-.172- Sig=.614	R=.077 Sig=.822	R=.542 Sig=.085	R=-.170- Sig=.618	R=-.261- Sig=.439	R=.529 Sig=.094
E 15 µg	R=.812** Sig=.002	R=-.416- Sig=.204	R=-.106- Sig=	R=-.233- Sig=.490	R=-.245- Sig=.468		R=-.009- Sig=.978	R=.141 Sig=.680	R=.153 Sig=.653	R=.178 Sig=.600	R=.460 Sig=.155	R=.223 Sig=.510	R=.111 Sig=.746
NV 30 µg	R=-.086- Sig=.803	R=-.290- Sig=.387	R=-.026- Sig=.939	R=-.751** Sig=.008	R=.373 Sig=.258	R=-.009- Sig=.978		R=.092 Sig=.788	R=-.227- Sig=.501	R=-.113- Sig=.741	R=-.192- Sig=.572	R=-.159- Sig=.641	R=.030 Sig=.930
PY 100 µg	R=.050 Sig=.884	R=-.244- Sig=.470	R=-.492- Sig=.124	R=-.126- Sig=.713	R=-.172- Sig=.614	R=.141 Sig=.680	R=.092 Sig=.788		R=-.248- Sig=.461	R=.052 Sig=.880	R=-.304- Sig=.364	R=-.223- Sig=.511	R=-.661-* Sig=.027
SMZ 25 µg	R=.054 Sig=.875	R=-.351- Sig=.290	R=.037 Sig=.915	R=.459 Sig=.155	R=.077 Sig=.822	R=.153 Sig=.653	R=-.227- Sig=.501	R=-.248- Sig=.461		R=.230 Sig=.496	R=.650* Sig=.030	R=-.007- Sig=.984	R=.547 Sig=.081
ATM 30 µg	R=.123 Sig=.718	R=-.010- Sig=.977	R=.393 Sig=.231	R=.083 Sig=.809	R=.542 Sig=.085	R=.178 Sig=.600	R=-.113- Sig=.741	R=.052 Sig=.880	R=.230 Sig=.496		R=.232 Sig=.492	R=.403 Sig=.219	R=.448 Sig=.167
TMP 10 µg	R=.582 Sig=.060	R=.122 Sig=.722	R=.073 Sig=.831	R=.186 Sig=.584	R=-.170- Sig=.618	R=.460 Sig=.155	R=-.192- Sig=.572	R=-.304- Sig=.364	R=.650* Sig=.030	R=.232 Sig=.492		R=.148 Sig=.664	R=.429 Sig=.188
AK 30 µg	R=.116 Sig=.735	R=.099 Sig=.771	R=.379 Sig=.251	R=-.122- Sig=.721	R=-.261- Sig=.439	R=.223 Sig=.510	R=-.159- Sig=.641	R=-.223- Sig=.511	R=-.007- Sig=.984	R=.403 Sig=.219	R=.148 Sig=.664		R=.191 Sig=.574
AX 15 µg	R=.131 Sig=.702	R=-.012- Sig=.971	R=.706* Sig=.015	R=.209 Sig=.536	R=.529 Sig=.094	R=.111 Sig=.746	R=.030 Sig=.930	R=.661-* Sig=.027	R=.547 Sig=.081	R=.448 Sig=.167	R=.429 Sig=.188	R=.191 Sig=.574	

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

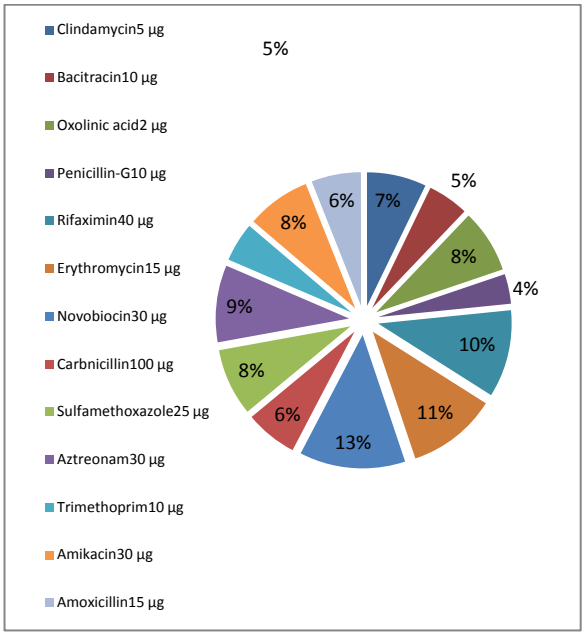

Figure:4. Percentage activity of the antibiotics types against *Proteus* spp.

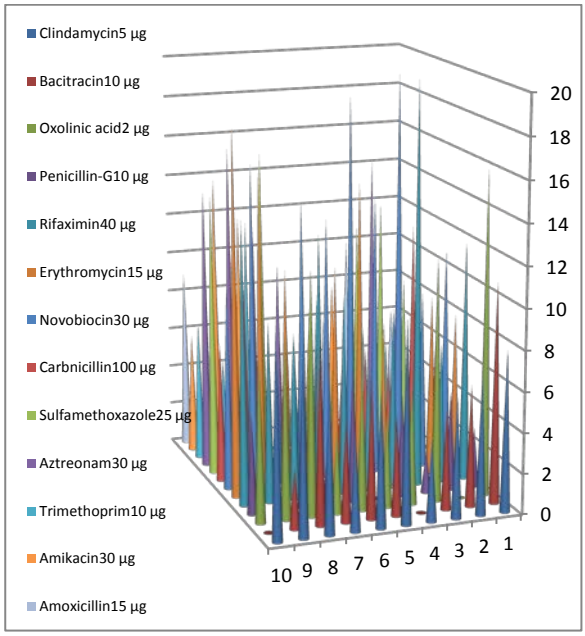

Figure:5. Zone replicates of the antibiotics types against *Proteus* spp.

Figure (4) the activity of the antibiotics measured as the percentage, and this showed the Novobiocin has high activity percent equal to (13%) while the Penicillin-G10 has low activity percent equal to (4%) against *Proteus* spp. from all antibiotic activities.

Figure (5) types of the antibiotics produced inhibition zones with different sizes when they act as repeaters against *Proteus* spp., the Novobiocin has largest inhibition zone equal to (20 mm).

Table (6) the significant differences between the same antibiotic activity against both *Enterobacter* spp. and *Proteus* spp. at p-value equal to (0.05) according to LSD system.

The antibiotics Aztreonam, Novobiocin and Clindamycin have significant difference between the *Enterobacter* spp. and *Proteus* spp. were equal to (0.001), (0.001) and (0.05) respectively. While the other types of the antibiotics have no significant differences. This means that the antibiotic that has activity against *Enterobacter* and has significant difference with same antibiotic against *Proteus* which can be used in the treatment of the *Enterobacter* species and cannot be used in the treatment of the *Proteus* species and visa versa. Whereas if no significant difference is present between same antibiotic against different bacterial species which can be used in treatment both bacterial species if has activity and cannot be used if has no activity.

Table:6. Significant differences between the same antibiotic type against different bacteria according to LSD system at 0.05 level.

Multiple Comparisons			
***Proteus* spp.**	*Enterobacter* spp.		
	Amoxicillin15 µg	M.D. **	1.700
		Sig.	0.283
	Amikacin30 **µg**	M.D. **	2.100
		Sig.	0.186
	Trimethoprim10 **µg**	M.D. **	4.800
		Sig.	0.003*
	Aztreonam30 **µg**	M.D. **	8.600
		Sig.	0.001*
	Sulfamethoxazole25 **µg**	M.D. **	2.100
		Sig.	0.273
	Carbnicillin100 **µg**	M.D. **	2.300
		Sig.	0.231
	Novobiocin30 **µg**	M.D. **	6.400
		Sig.	0.001*
	Erythromycin15 **µg**	M.D. **	1.800
		Sig.	0.329
	Rifaximin40 **µg**	M.D. **	1.600
		Sig.	0.385
	Penicillin-G10 **µg**	M.D. **	2.600
		Sig.	0.098
	Oxolinic acid2 **µg**	M.D. **	0.800
		Sig.	0.608
	Bacitracin10 **µg**	M.D. **	1.900
		Sig.	0.225
	Clindamycin5 **µg**	M.D. **	3.100
		Sig.	0.050*
*Significant differences of mean			
** Differences of mean			

Figure (6) the Novobiocin has more activity against *Proteus* spp. while the Aztreonam has more activity against *Enterobacter* spp. as well as the Aztreonam that has more activity when comparison of all antibiotics used together.

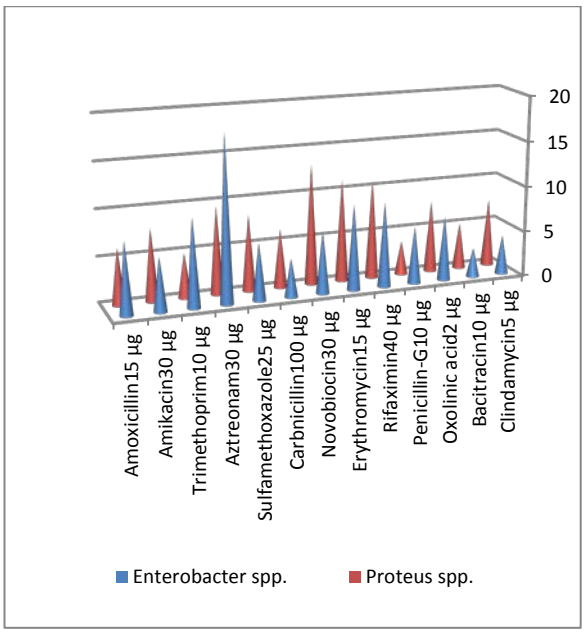

Figure:6. Comparisons between of the antibiotics types activity against *Enterobacter* spp. and *Proteus* spp.

DISCUSSION

Figure (1) the percentage of the *Enterobacter* spp. and *Proteus* spp. isolated from urine were (10%) and (13%) respectively, and when comparing these results with the results of the Hryniewicz *et al* who found the isolates of the *Enterobacter* spp. and *Proteus* spp. from urine were (9.6%) and (8.9%) respectively [19]. Whereas the Kibret and Abera who found the percentage of *Enterobacter* spp. and *Proteus* spp. isolated from urine were (2.2%) and (8.2) respectively [20]. The causative agents and infectious factors of the urinary tract varied according to the geographical areas and the range of the antibiotics resistance during the time [21]. The *Enterobacter* spp. can present in the urine and other types of samples [22]. The urine samples include the *Proteus* spp. more prevalence than the other types of the clinical samples [23].

Table (2) and figure (2) explained the Aztreonam has high activity against *Enterobacter* spp. while the Bacitracin has low activity against these bacterial species and when comparing these result with the other researchers found the Igari who presented the Aztreonam has high activity against these bacterial species [24]. But the Giamarellou *et al* who found the isolates of these bacteria were resistant to this antibiotic [25]. Whereas the Sharma *et al* found the isolates of these bacteria were resistant to Bacitracin antibiotic [26]. The resistance of the antibiotics among the *Enterobacter* spp. varied according to the samples sources, geographic locations and animal hosts as well as the environmental conditions and genetic transmission among genetic elements may effect on multidrug resistance among these bacterial species [27]. Most *Enterobacter* spp. isolates are resistance to many antibiotics types [28].

Table (4) and figure (4) the Novobiocin which has high activity against *Proteus* spp. while the Penicillin-G has low activity against these bacterial species and when comparing these result with the other researchers found the Safary *et al* who presented the Novobiocin has high activity against these bacterial species [29]. But the Al-Mutairi *et al* who found this antibiotic has low activity against these bacteria [30]. Whereas the Stock found the isolates of these bacteria were resistant to Penicillin-G antibiotic [31]. The most important resistance mechanism among the *Proteus* spp. is including expression of the beta-lactamase through chromosomal genes, as well as can be acquired this resistance type through plasmid contain beta-lactamases mediated genes [32]. The isolates of the *Proteus* spp. can naturally resistance several types of the antibiotics [33].

Figures (3 and 5) each type of the antibiotic showed different pattern of the activity and this reflect both the type of the resistance mechanisms among bacterial species and the size of the inhibition zones among antibiotic activity, as well as the showed the Aztreonam produced largest inhibition zone was equal to (25 mm) against *Enterobacter* spp. whereas the Novobiocin and Rifaximin produced largest inhibition zone were both equal to (20 mm) against *Proteus* spp. These differences may be caused by the geographic variations among the different strains of the pathogenic gram negative bacteria [34-35]. However, widespread of the antibiotic use stimulated different bacterial resistance mechanisms against these antibiotics [36]. These bacterial resistances mechanisms include, antibiotics degradation enzymes, cell permeability alteration, change in the antibiotic binding site and activity of the efflux pump [37-39].

Tables (3,5 and 6) the significant correlations and differences between all used antibiotics as well as the Aztreonam and Novobiocin have high activity against *Enterobacter* spp. and *Proteus* spp. respectively. Aztreonam antibiotic has more activity against *Enterobacter* spp. isolates [40]. Novobiocin antibiotic has high activity against *Proteus* spp. isolates [41]. And figure (6) the Aztreonam has high activity when comparing the activity of the all used antibiotics. the Aztreonam is the first antibiotic use and

treatment of the different infections caused by pathogens of the gram negative and most *Enterobacteriaceae* species [42]. And this antibiotic has activity in the treatment the infections of both lower and upper urinary tract [43].

CONCLUSIONS

The number and percentage of the *Proteus* spp. isolates in urine samples were more than *Enterobacter* spp. isolates. And the Aztreonam has high activity against *Enterobacter* spp. while the Novobiocin has high activity against *Proteus* spp. and the Aztreonam has high activity when comparing the activity all used antibiotic.

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