Detection of *Proteus mirabilis* in Healthy, sick and Diarrheal Dogs, Cats and Humans

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Abstract

The current work was conducted for isolation, identification and epidemiological frequency and distribution of *Proteus mirabilis* from humans and Dogs, cats, scanning Vitek in addition (PCR) assay was confirm detect isolates and Api 20E technique is also used in order diagnosis of *P. mirabilis* then determination of antibiotics susceptibility pattern of recovered isolates. The human isolates showed that (89.47%) were resistant Ampicillin, (42.10%) Ofloxacin, (57.14%) Cefoxitin, (57.14%) Gentamycin, (100%) Vancomycin, (57.14%) Chloramphenicol, (89.47%) Trimethoprim, (100%) Amoxiclav, (57.89%) Streptomycin, (100%) Tetracycline, (89.47%) Penicillin, (100%) Erythromycin. The dogs isolates showed resistance (64.28%) was resistant Ampicillin, (35.71%) Ofloxacin, (46.1%) Cefoxitin, (53.8%) Gentamycin, (64.28%) Vancomycin, (47.3%) Chloramphenicol, (64.28%) Trimethoprim, (64.28%) Amoxiclav, (42.85%) Streptomycin, (64.28%) Tetracycline, (64.28%) Penicillin, (64.28%) Erythromycin, otherwise the cat's isolates showed resistance (35.71%) were Ampicillin -resistant, for Ofloxacin (35.71%), for Cefoxitin (35.71%), for Gentamycin (35.71%), for Vancomycin (35.71%), for Chloramphenicol (35.71%), for Trimethoprim (35.71%), for Amoxiclav (35.71%), for Streptomycin (35.71%), for Tetracycline (35.71%), for Penicillin (35.71%), for Erythromycin (35.71%). The *Proteus mirabilis* was isolated from 33 out of 195 sample (16.92%) distributed as 19 isolated from human and 14 from Dogs and Cats. The human isolates showed that (89.47%) were resistant Ampicillin, (42.10%) Ofloxacin, (57.14%) Cefoxitin, (57.14%) Gentamycin, (100%) Vancomycin, (57.14%) Chloramphenicol, (89.47%) Trimethoprim, (100%) Amoxiclav, (57.89%) Streptomycin, (100%) Tetracycline, (89.47%) Penicillin, (100%) Erythromycin.

Keywords**:** *Proteus mirabilis*, *dogs and cats, VITEK®, Api20, Antibiotics.*

Introduction

Proteus spp. considered as G- bacillus of family of Enterobacteriaceae. Members of genus Proteus in the ecosystem are widely spread in animals and humans GI tract [(1)]. Proteus rod pathogens are opportunistic bacterial pathogens that cause infections in urinary tract (UT), infections of wound, kids or neonates meningitis, and Rheumatoid arthritis under favorable conditions [(2)(3)(4)] . E. coli have been was a widespread reason of infections being un-complicated [(5)]. Habitat of Proteus spp. is of normal flora part of gastrointestinal (GI) and urogenital tracts, and skin in dog, cat and human. It may be cross-linked with other Enterobacteriaceae, with transfer of plasmids and also, their transmission occurs as endogenous or exogenous infections[(6)] and genital infections tract, such as (epididymitis/ orchitis) and external otitis in cats and dogs, sometimes as part of mixed infections[(7)]. Other host effects, like the part of normal GI flora and part of normal skin flora in some dogs and cats. Maybe can the control via chemotherapies and this susceptibility of antibiotics, including beta-lactams, potentiated sulfonamides and cephalosporins[(8)(9)]. Also, it is a prevalent bacteremia cause following catheter-allied UT infections. At occasional circumstances, endocarditis, cellulite, empyema, osteomyelitis, and mastoiditis were seemingly caused[(10)]. It is suggested that intestines of human considered as are Proteus bacteria reservoir, particularly such belonging to the prevailing P. mirabilis species, and are several percent members of the human population of natural fecal microflora(11).

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Material and Methods

1. Collection of Samples:

105 urine Samples, stool, nasal and oral swab from diarrhea and stable people obtained, and a total of 90 samples were taken from cat and dog from urine feces, and nasal & oral swabs and usage containers.

2. Antimicrobial susceptibility test

Based on (NCCLS) recommendations, antimicrobial test of susceptibility was pereformed on media of MHA utilizing diffusion process of Kirby Bauer disc.

Results

1. Isolation of *Proteus spp*.

Table 1 Sample types, *P. mirabilis* number and % isolated from samples of human, cats and dogs

Sample types	Samples #	Isolates #	%
Human	105	19	18.09 %
Dogs and cats	90	14	15.55 %
Total	195	33	16.92%
Chi-Square (χ2)	---	---	1.608 NS
NS: Non-Significant. +			

2. Antimicrobial susceptibility

Table 2 Susceptibility as antimicrobial versus isolates of *P. spp*. in human

	Type of antimicrobial	*S	I	M.S	R
1.	Ampicillin(25)	0(0.0%)	15-16	2 (10.52%)	17(89.47%)
2.	Penicillin G(10)	2(10.52%)	11-12	0(0.0%)	17(89.47%)
3.	Trimethoprim-Sulfamethoxazole(25)	2(10.52%)	13-14	0(0.0%)	17(89.47%)
4.	Streptomycin(25)	7(36.84%)	12-14	1(5.26%)	11(57.89%)
5.	Chloramphenicol(30)	5(26.31%)	13-17	5(26.31%)	9(47.3%)
6.	Clavulanic /Amoxicillin Acid(30)	0(0.0%)	15-16	0(0.0%)	19(100%)
7.	Erythromycin(10)	0(0.0%)	14-22	0(0.0%)	19 (100%)
8.	Tetracycline(10)	0(0.0%)	15-18	0(0.0%)	19 (100%)
9.	Gentamicin(10)	8(42.10%)	13-14	3(15.78%)	8(42.10%)
10.	Ofloxacin(5)	9(47.36%)	13-17	2(10.52%)	8(42.1 0%)
11.	Cefoxitin(25)	0(0.0%)	15-16	0(0.0%)	19(100%)
12.	Vancomycin(30)	0(0.0%)	15-16	0(0.0%)	19(100%)
Chi-Square(χ2)		10.285**	---	8.452**	10.661**
** (P≤0.01)-Highly Significant.					

*S= sensitive, I= intermediate, M S= moderate sensitive and R= resistant.

Table 3; Susceptibility as antimicrobial versus isolates of *P. spp*. in dogs

	Type of antimicrobial	Dog			
		*S	I	M S	R
	Ampicillin(25)	0(0.0%)	15-16	0(0.0%)	9(64.28%)
2.	Penicillin G(10)	0(0.0%)	11-12	0(0.0%)	9(64.28%)
3.	Trimethoprim-Sulfamethoxazole(25)	0(0.0%)	13-14	0(0.0%)	9(64.28%)
4.	Streptomycin(25)	3(21.42%)	12-14	0(0.0%)	6(42.85%)
5.	Chloramphenicol(30)	1(7.14%)	13-17	0(0.0%)	8(57.14%)
6.	Clavulanic /Amoxicillin Acid(30)	0(0.0%)	15-16	0(0.0%)	9(64.28%)
7.	Erythromycin(10)	0(0.0%)	14-22	0(0.0%)	9(64.28%)
8.	Tetracycline(10)	0(0.0%)	15-18	0(0.0%)	9(64.28%)
9.	Gentamicin(10)	1(7.14%)	13-14	0(0.0%)	8(57.14%)
10.	Ofloxacin(5)	4(28.57%)	13-17	0(0.0%)	5(35.71%)
11.	Cefoxitin(25)	1(7.14%)	15-16	0(0.0%)	8(57.14%)
12.	Vancomycin(30)	0(0.0%)	15-16	0(0.0%)	9(64.28%)
Chi-Square(χ2)		8.239**	--	0.0 0NS	10.472**
** (P≤0.01)-Highly Significant., NS: Non-Significant.					

*S= sensitive, I= intermediate, M S= moderate sensitive and R resistant.

Table 3. Susceptibility as antimicrobial versus isolates of *P. spp*. in cats

#	Type of antimicrobial	Cat			
		*S	I	M S	R
	Ampicillin(25)	0(0.0%)	15-16	0(0.0%)	5(35.71%)
	Penicillin G(10)	0(0.0%)	11-12	0(0.0%)	5(35.71%)
	Trimethoprim-Sulfamethoxazole(25)	0(0.0%)	13-14	0(0.0%)	5(35.71%)
	Streptomycin(25)	0(0.0%)	12-14	0(0.0%)	5(35.71%)
	Chloramphenicol(30)	0(0.0%)	13-17	0(0.0%)	5(35.71%)
	Clavulanic /Amoxicillin Acid(30)	0(0.0%)	15-16	0(0.0%)	5(35.71%)
	Erythromycin(10)	0(0.0%)	14-22	0(0.0%)	5(35.71%)
	Tetracycline(10)	0(0.0%)	15-18	0(0.0%)	5(35.71%)
	Gentamicin(10)	0(0.0%)	13-14	0(0.0%)	5(35.71%)
	Ofloxacin(5)	0(0.0%)	13-17	0(0.0%)	5(35.71%)
	Cefoxitin(25)	0(0.0%)	15-16	0(0.0%)	5(35.71%)
	Vancomycin(30)	0(0.0%)	15-16	0(0.0%)	5(35.71%)
Chi-Square(χ2)		0.0 0NS	---	0.0 0NS	0.0 0NS
** (P≤0.01)-Highly Significant., NS: Non-Significant.					

*S= sensitive, I= intermediate, M S= moderate sensitive and R= resistant.

Discussion

This study revealed the prevalence of *P. mirabilis* (18.09%,) in human, this not agreed with [12], who stated that *P. mirabilis* infections prevalence is (90%). Although, it was higher than the other recorded with [13] [14]. In addition, our study recorded lower percentage than [16][17]. In clinical infections, *P. mirabilis* are further widespread compared to other *P.spp*., due to that *P. mirabilis* is normal flora part of human as well as mammalians which causes water contamination and this not agreed with [18], who reported (7.8%).According to gender distribution this study showed that the human females (11.42%) are more susceptible to infection with *P. mirabilis* than males (6.66%) and this agreed with [14]. The current work showed infections by Proteus were identified in all groups of age from <1 to 70 years where 20-35 years group of age recording as the highest infected group while age groups from 50 to 70 years recording as low group infected. On other hand the age group from <1 to 12 years which recorded moderate (18.09%) was the predominant species isolated from various clinical samples in different studies as reported [19][17], who reported (52.54%).Females were observed as more susceptible in Proteus acquiring infections comparing to males. In our study recorded 36.84% of *P. mirabilis* were isolated from whole human urine positive samples where these samples are higher than [20] [21], who recorded (19.64%) [19], who recorded (1.12%), which was highly level when compared with findings of [22], who reported a prevalence rate of (19.3%) in human urine samples while according to and[23] who reported an overall prevalence of 17.6%. In contrast, [24] reported a lower prevalence of *P. mirabilis* (4.8%) in urine samples of humans. On other side[25] mentioned *Proteus mirabilis* was (66%) this percentage not agreed with our study *P. mirabilis* has a greater tendency for UT colonizing because of pathogenicity difference [26]. *P. mirabilis* is associated commonly with both UT infections of community-assimilated and catheter-related, pyelonephritis and cystitis. They are associated less frequently in respiratory infections, endophthalmitis, and infections with CNS like [27][28].This study shows that is females infection are (63.15%) which is higher than[29][19] but the percentage of male's infection are (36.84%) lower than [29] as well as[19]. In the present study, the *Proteus mirabilis* show different percentage of resistance to antimicrobial drugs in human and animal (cat and dog). Such isolates are of non-lactose pale along fishy odor fermented, motile (swarming phenomenon) and lead to βhemolysis colonies on agar of blood, based on [30]. Furthermore, the latter reason is probably because the VITEK 2 system has a greater spectrum of microorganisms in its database with respect to the Micro-Scan system, and thus there could be differences in the software used in the equipment of both systems, as has been reported in other systems. Studies(31)(32) Although the results of identification of *P. mirabilis* using Vitek system showed all isolates were *P. mirabilis* and the percentage of identification was ranged from (95-99%), and this percentage was in agreement with[33] as it was stated that reported that *P. spp*. identification via system of Vitek 2 was in 97%. Furthermore, such isolates are of non-lactose pale along fishy odor fermented, motile (swarming phenomenon) and lead to βhemolysis colonies on agar of blood, based on [30]. In human isolates show (100%) resistance to Amoxicillin / Clavulanic Acid, Erythromycin, Tetracycline, Cefoxitin and Vancomycin. On the other hand, streptomycin was showed (57.89%) resistant and not agreed with [34] who was reported (0.0%) may be due to etiological UT infections agents and their patterns of susceptibility/ resistance differ based on locations of geography [35] may be because of likely recurrent UT infections attacks among such group causing recurrent antimicrobial use, catching antimicrobial being wrong for bacteriuria as asymptomatic, or others infections treatment [36]. The reason for this may be due to elderly people especially females are recognized to be disposed to develop bacteriuria as asymptomatic and UT infections as recurrent, that associated along factors of risk among such gender and age category[37].In addition, these bacteria were able to generate β-lactamases, in particular extended spectrum of β-lactamases (ESBLs), along their capability to transfer elements of genetic transporting the such enzymes genes, and mutations variety take place along such enzymes forms, causing increased resistance to antibiotic, in particular β-lactam, besides other mechanisms i.e., alt-site alteration or target site alteration (38)(39). Proteus mirabilis were isolated from dog urine with ratio (14.28%) to sick case and this isolation percentage frequencies vary among different reports as (9 - 32%) for Proteus mirabilis according to[40] and due to In UTIs an underlying abnormality exists that predisposes the dog to develop a UTI or fail treatment. This can include abnormal function or anatomy of the urogenital tract, or concurrent diseases, all of which may predispose the dog to acquire a UTI or make resolution difficult the prostate [41]. As for the isolation of dogs and cats, showed resistant many antibiotics in this study and this resistance can be due to diseases variety including

UT infections and diarrhea [42]. Likewise, the specific physiological bacterium characteristics promoted its resistance to drug [43]. Otherwise, acquired antimicrobial resistance in cats was determined by investigated population social environment. It is clear that healthy cat's flora may behave as resistance genes reservoir. Or may be attributable to differences of the antibacterial sensitivity tests performed.

Conflict of Interest – Nil

Source of Funding- Self

Ethical Clearance – Not required

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