

Comparative Study of the Antibiotic Resistance Exhibited by Fecal Coliforms Obtained from Dighi Talab and Bisar Talab of Gaya, Bihar (India)

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Abstract: The antibiotic resistance pattern of four types of fecal coliform bacteria obtained from two fresh water ponds of Gaya was examined during present research work. Data obtained showed that cent per cent of the total isolates (83) of *E. coli* obtained from water sample of Dighi Talab showed resistance against Ampicillin as well as 83.13%, 71.08%, 69.88% and 32.53% remained resistant against Erythromycin, Gentamycin, Tetracycline and Chloramphenicol respectively. Cent per cent of the total isolates (27) of *K. pneumoniae* obtained from the water sample of this pond remained resistant against Tetracycline as well as 96.30%, 92.59%, 25.93% and 18.52% of total isolates showed resistance against Erythromycin, Ampicillin, Chloramphenicol and Gentamycin respectively. Out of the total (26) isolates of *P. aeruginosa* obtained from water sample of this pond 96.15%, 88.46%, 80.77% and 34.62% exhibited resistance against Tetracycline, Ampicillin, Erythromycin, Gentamycin and Chloramphenicol respectively. Cent per cent of the total isolates (06) of *Salmonella sp.* obtained from the water of this pond remained resistant against Tetracycline as well as 83.33% remained resistant against Ampicillin, Gentamycin and Chloramphenicol. Only 66.67% of *Salmonella sp.* obtained from this pond remained resistant against Erythromycin. Out of the total (40) isolates of *E. coli* obtained from water sample of Bisar Talab, 97.50%, 95%, 87.50%, 75% and 60% showed resistance against Ampicillin, Tetracycline, Erythromycin, Gentamycin and Chloramphenicol respectively. Whereas, out of the total (36) isolates of *K. pneumoniae* obtained from this pond, cent per cent exhibited resistance against Ampicillin and Gentamycin. But 91.67%, 83.33% and 19.44% of the total isolates of this bacteria obtained from this pond and tested during present research work exhibited resistance against Tetracycline, Erythromycin and Chloramphenicol respectively. Out of the total (27) isolates of *P. aeruginosa* obtained from water of this pond, 24, 22, 17 and 13 exhibited resistance against Ampicillin & Tetracycline, Erythromycin, Chloramphenicol and Gentamycin respectively. Only two isolates of *Salmonella sp.* were obtained from the water sample of this pond, out of which one remained resistant against Gentamycin and Chloramphenicol whereas both remained resistant against Ampicillin, Erythromycin and Tetracycline. The main cause of antibiotic resistance exhibited by different bacterial isolates should be examined by future research.

Keyword: Antibiotic Resistance, Fecal coliforms, Dighi Talab, Bisar Talab

1. Introduction

Antibiotics discharges in water body remain resistant to biodegradation. More investigations in different parts of world are conducted with regard to antibiotic resistance among fecal coliforms present in different aquatic ecosystems. Antibiotic resistance gene transfer mainly takes place through *E. coli* of fecal origin because this bacteria remain abundant in aquatic ecosystems. Grabow and Prozesky (1973) pointed out that 30% of all coliform bacteria of fecal origin have transferable antibiotic resistance through cell to cell contact, through R-factor or R-plasmid, and extrachromosomal genetic material. Mudryk and Skorcowski (2009) analysed the frequency of antibiotic resistance in bacteria inhabiting water of a pond and obtained significant result. Toroglu *et al.* (2005) examined the antibiotic resistance pattern in Gram negative bacteria obtained from a river of Turkey. *Salmonella* bacteria is also called as target bacteria which acquire resistance genes horizontally and develops multi-drug resistance. Selective pressure on pathogenic fecal bacteria increased due to increasing use of different antibiotics by humans. They pointed out that *E. coli*, *Salmonella*, *K. pneumoniae* and *P. aeruginosa* are used as indicators of water quality. In above mentioned perspective the antibiotic resistance pattern of four types of fecal coliforms obtained from two ponds of Gaya were evaluated.

2. Materials and Method

Water samples from both ponds under study were collected in the month of July, 2022 in sterilized bottles, properly capped and transported to the laboratory. Bacterial isolates were cultured on nutrient agar media. Identification of bacterial isolates was conducted on the basis of morphological characteristics and biochemical characterization with the help of standard literature. Antibiotic resistance properties of each bacterial isolated obtained from both ponds were examined separately by Kirby-Bauer Disc Diffusion method (1966). Ampicillin and Gentamycin with disc concentration of 10µg, Chloramphenicol and Tetracycline with 10disc concentration of 30 µg as well as Erythromycin with disc concentration of 15µg were used during present experimentation. Bacteria exhibiting zone of inhibition as ≤ 11 (mm) with Ampicillin, ≤ 12 (mm) with Gentamycin and Chloramphenicol ≤ 13 (mm) with Erythromycin and ≤ 14 (mm) with Tetracycline were considered as resistant.

3. Result and Discussion

It became evident from the data presented in Table-01 that out of 83 isolates of *E. coli* obtained from Dighi Talab, all showed resistance against Ampicillin and 69, 59, 58 and 27 isolates showed resistance against Erythromycin, Gentamycin, Tetracycline and Chloramphenicol

respectively. Out of the 27 isolates of *K. pneumoniae* obtained from water sample of this pond, all showed resistance against Tetracycline as well as 26, 25, 07 and 05 isolates exhibited resistance against Erythromycin, Ampicillin, Chloramphenicol and Gentamycin respectively

Total 06 isolates of *Salmonella* sp. were isolated from this pond, among them, all 06 exhibited resistance against Tetracycline; 05 against Ampicillin, Gentamycin and Chloramphenicol as well as 04 against Erythromycin.

Table 1: Antibiotic Resistance Pattern of Bacterial Isolates obtained from Dighi Talab

S. No.	Bacterial Isolates	Antibiotic Resistance										Total Isolates
		Ampicillin		Erythromycin		Gentamycin		Chloramphenicol		Tetracycline		
		No.	%	No.	%	No.	%	No.	%	No.	%	
1	<i>E.coli</i>	83	100	69	83.13	59	71.08	27	32.53	58	69.88	83
2	<i>K. pneumoniae</i>	25	92.59	26	96.30	05	18.52	07	25.93	27	100	27
3	<i>P. aeruginosa</i>	23	88.46	21	80.77	14	53.85	09	34.62	25	96.15	26
4	<i>Salmonella sp.</i>	05	83.33	04	66.67	05	83.33	05	83.33	06	100	06

Table 2: Antibiotic Resistance Pattern of Bacterial Isolates obtained from Bisar Talab

S. No.	Bacterial Isolates	Antibiotic Resistance										Total Isolates
		Ampicillin		Erythromycin		Gentamycin		Chloramphenicol		Tetracycline		
		No.	%	No.	%	No.	%	No.	%	No.	%	
1	<i>E.coli</i>	39	97.50	35	87.50	30	75.00	24	60.00	38	95.00	40
2	<i>K. pneumoniae</i>	36	100	30	83.33	36	100	07	19.44	33	91.67	36
3	<i>P. aeruginosa</i>	24	88.89	22	81.48	13	48.15	17	62.96	24	88.89	27
4	<i>Salmonella sp.</i>	02	100	02	100	01	50.00	01	50.00	02	100	02

Data mentioned in Table-02 indicates that out of the 40 isolates of *E. coli* obtained from water sample of Bisar Talab, 39, 38, 35, 30 and 24 exhibited resistance against Ampicillin, Tetracycline, Erythromycin, Gentamycin and Chloramphenicol respectively. Altogether 36 isolates of *K. pneumoniae* were obtained from the water sample of this

sample of this pond, out of which 24, 22, 17 and 13 remained resistant against Ampicillin & Tetracycline, Erythromycin, Chloramphenicol and Gentamycin respectively. Out of the 02 isolates of *Salmonella* sp. obtained from the water sample of this pond, one remained resistant against Gentamycin and Chloramphenicol. Both isolates of *Salmonella* sp. obtained from water of this pond showed resistance against Ampicillin, Erythromycin and Tetracycline.

Antibiotic resistance pattern of different fecal bacteria and presence of resistance gene were observed in waste water discharged in water bodies by Andersen (1993), Iwane *et al.* (2001), Schwartz *et al.* (2003) and Luczkiewicz *et al.* (2010). They pointed out that antibiotic resistance genes can spread by fecal contamination leaking from septic tanks and sewage as well as sanitary pipes. Micro-biological quality of the water of any pond requires periodic monitoring because presence of fecal coliforms often remain associated with presence of other pathogenic bacteria (Abdul Salam *et al.*, 2012). Karaca *et al.* (2023) observed 40% antibiotic susceptibility of *E. coli* obtained from Orontes river (Turkey) against Ampicillin. They conducted their study by Kirby Bauer Method.

Americo-Pinheiro *et al.* (2021) pointed out that indiscriminate use of antibiotics in human medicine remain responsible for the emergence of resistant bacterial strains against different antibiotics in the water bodies. Ozgumus *et al.* (2009) also isolated Ampicillin resistant *E.coli* while examining the water samples obtained from ten rivers of Turkey. The results obtained during present research work remain in conformity with results obtained by Abdulsalam

pond, out of which 33,30 and 07 remained resistant against Tetracycline, Erythromycin and Chloramphenicol respectively. But all strains of *K. pneumoniae* remained resistance against Ampicillin and Gentamycin. Altogether 27 isolates of *P. aeruginosa* were obtained from the water

et al. (2012), Karaca *et al.* (2023) and Ozgumes *et al.* (2009).

4. Conclusion

Out of the total isolates (83) of *E. coli* obtained from the water sample of Dighi Talab, 32.53% showed multi-drug resistance against all tested antibiotics. 18.52% of *K. pneumoniae*, 34.62% of *P. aeruginosa* and 66.67% of *Salmonella* sp. obtained from the water sample of this pond showed multi-drug resistance against all tested antibiotics. Out of the total isolates (40) of *E.coli* obtained from water sample of Bisar Talab, 60% showed multi-drug resistance against all five tested antibiotic drugs. As well as, 19.44% of total *K. pneumoniae*, 48.15% of *P. aeruginosa* obtained from this pond showed multidrug resistance and one out of two isolates of *Salmonella* sp. showed multi-drug resistance against all tested antibiotics. Thus it became evident that water of Dighi Talab contains high number of antibiotic resistant bacteria as compared to Bisar Talab. This may be due to high level of anthropogenic activities with Dighi Talab and low level of anthropogenic activities with Bisar Talab of Gaya.

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