

HIGH PREVALENCE OF MULTI-DRUG RESISTANT ESCHERICHIA COLI IN DRINKING WATER SAMPLES FROM HYDERABAD

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ABSTRACT

Background: Antibiotic resistance in pathogenic bacteria is a serious public health issue. Various factors contribute to the spread of antibiotic-resistant micro-organisms in the environment. This study was aimed at measuring the antibiotic sensitivity profile of *Escherichia coli* in drinking water samples from Hyderabad.

Material & Methods: Samples of drinking water were collected from various locations in Hyderabad city. Antibiotic resistance pattern was determined against commonly used antibiotics, using standard Disc Diffusion method.

Results: Out of 42 samples collected in 27 (64.29%) *E. coli* were isolated. Maximum resistance was observed against Nalidixic Acid (92.6%), followed by Ampicillin (88.89%), ceftriaxone (40.74%), ciprofloxacin (37.04%), ceftazidime (25.23%), cefotaxime (18.52%), and gentamicin (18.52%). Whereas none of the *E. coli* isolates showed resistance against Amikacin. Multi-drug resistance (3-6 antimicrobials) was seen in 62.96% of *E. coli* isolates from drinking water.

Conclusion: Drinking water in Hyderabad is heavily contaminated with potentially pathogenic multi drug resistant strains of *E. coli*. The source could possibly be the mixing of sewage lines with drinking water supply. Presence of multi drug resistant *E. coli* in drinking water can act as a vehicle to disseminate antibiotic resistance to other bacteria. This suggests a need to educate people regarding the rational use of antibiotics and safe disposal of antibiotic containing waste.

Key words: Drinking water, *Escherichia coli*, Antibiotic resistance, Multi-drug resistance.

INTRODUCTION

Faecal coliforms are a group of bacteria, which are natural inhabitants of the gut of humans and other warm-blooded animals. *Escherichia coli* (*E. coli*) is a member of fecal coliforms that contaminate the drinking water from human and animal fecal waste. During rainfalls these coliforms may be washed into creeks, rivers, streams, lakes, or ground water. Untreated drinking water coming from these sources contains coliforms including *E. coli*. In developing countries such as Pakistan, drinking water supply lines and open sewage drains are laid side by side resulting in frequent contamination of water.¹ *E. coli* is an opportunistic pathogen in neonatal and immunocompromised patients.² Bacteremia, wound infections, urinary tract infection, and gastrointestinal infections are the diseases associated with *E. coli* and are often fatal in newborns.³ Food and water borne outbreaks of *E. coli* have been documented from a number of countries.^{4,5} The difficulties in the treatment of food and water associated gastrointesti-

nal diseases due to *E. coli* have been reported. This problem is compounded by the continued emergence of antibiotic resistance to a growing number of antibiotics; i.e. carbenicillin, tetracycline, streptomycin,⁶ norfloxacin, amoxicillin, trimethoprim, nitrofurantoin,⁷ nalidixic acid, gentamicin, cefuroxime,⁸ etc. Increase in antibiotic resistance level is now a global problem. Infections with antibiotic resistant bacteria makes the therapeutic options for infection treatment, extremely difficult or virtually impossible in some instances.⁹ Therefore, the determination of antimicrobial susceptibility of clinical isolate is often crucial for optimal antimicrobial therapy of infected patients. A high-density patient population in frequent contact with health care staff and the attendant risk of cross-infection contributes to the spread of antibiotic-resistant micro-organisms in the environment.¹⁰ Occurrence and prevalence of these resistant strains in environment is therefore, a usual kind of thing in the developing countries. Since water is one of the four components of environment, and a usual habitat for *E. coli*, therefore, the availabil-

ity of antibiotic resistant *E. coli* strains in water can not be denied. In fact multi-drug resistant (MDR) *E. coli* strains in drinking water have been reported by Walia SK.⁶

This study was aimed at measuring the antibiotic sensitivity profile of *Escherichia coli* in drinking water samples from Hyderabad.

MATERIAL AND METHODS

Hyderabad is the sixth populated city of Pakistan. To ensure adequate representation of the city, the samples were randomly collected from all three sub-divisions, from both residential and commercial areas, from the direct municipal supply and the storage tanks. The study duration was six months from September 2006 to February 2007.

A total of 42 drinking water samples from Hyderabad were collected in sterilized flasks. Samples were immediately brought to laboratory and inoculated in lactose broth.¹¹ After 24 hrs of incubation at 37°C, a loop full from Positive tubes were streaked to Mac Conkey's Agar. Suspected *E. coli* colonies were then identified by microscopical, and biochemical tests. A total of 27 (64.29 %) *E. coli* were thus isolated (Figure 1). Cultures were named as D1, D2, D3 and so on.

Antibiotic resistance profile: Antibiotic sensitivity testing was done using standardized Kirby Bauer Disc Diffusion Test.¹¹ (Figure 2) All *E. coli* iso-

lates were tested against eight commonly used antibiotics, i.e. Cefotaxime (30µg), Ciprofloxacin (5µg), Nalidixic Acid (30µg), Ampicillin (10µg), Ceftriaxone (30µg), Amikacin (30µg), Gentamicin (10µg), and Ceftazidime (30µg).

The disc diffusion tests were carried out using antibiotic sensitivity disks. A couple of *E. coli* colonies were picked from Nutrient Agar plates, mixed with 1ml. sterile saline to prepare homogeneous suspension. With the help of sterilized cotton swabs the suspension was spread plated on Muller Hinton agar. The antibiotic susceptibility discs were placed on the agar surface. The plates were then incubated at 37°C for 24 hours. The clear zones (zones of inhibition) around the discs were noted.

RESULTS

A large percentage (62.96%) of *E. coli* isolates exhibited resistance against 3 or more antibiotics, creating great public health concern. 25.92% isolates showed resistance to 3 antibiotics, whereas, 11.11% highly resistant strains were determined to be resistant to 6 antibiotics. (Figure 3)

Resistance was seen against Nalidixic Acid (92.6%), followed by Ampicillin (88.89%), ceftriaxone (40.74%), ciprofloxacin (37.04%), ceftazidime (25.23%), cefotaxime (18.52%), and gentamicin (18.52%). Whereas, none of the *E. coli* isolates showed resistance against Amikacin. (Figure 4).

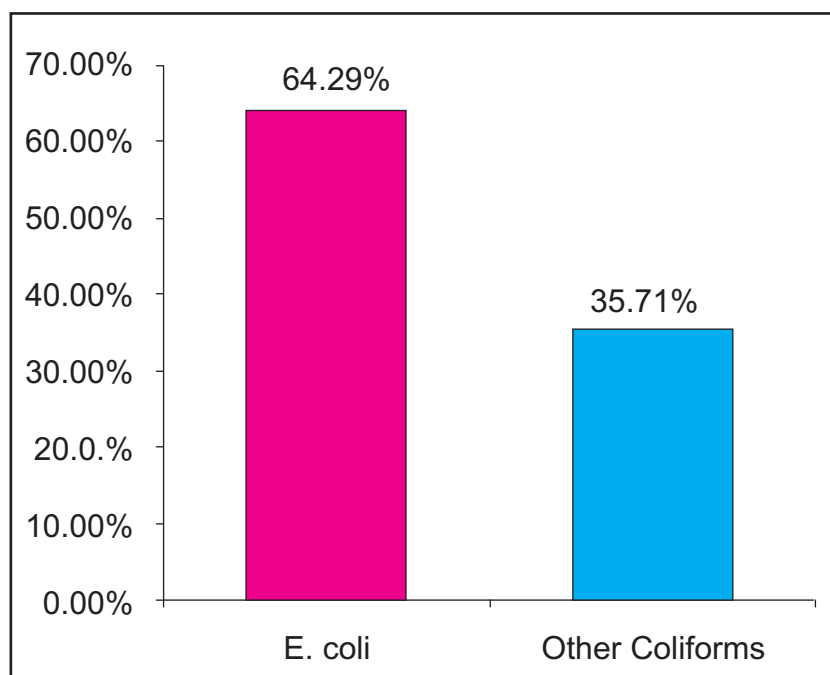


Fig. 1: Percentage of *E. coli* isolated from drinking water.

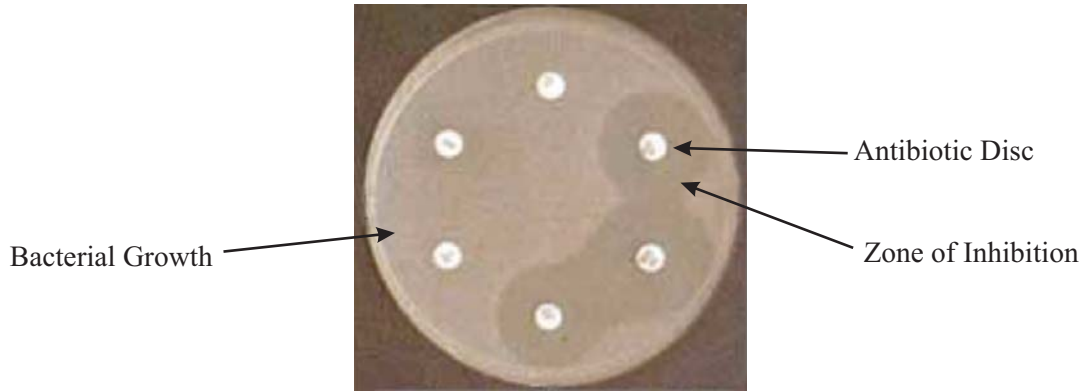


Fig. 2: Display of standard disc diffusion method.

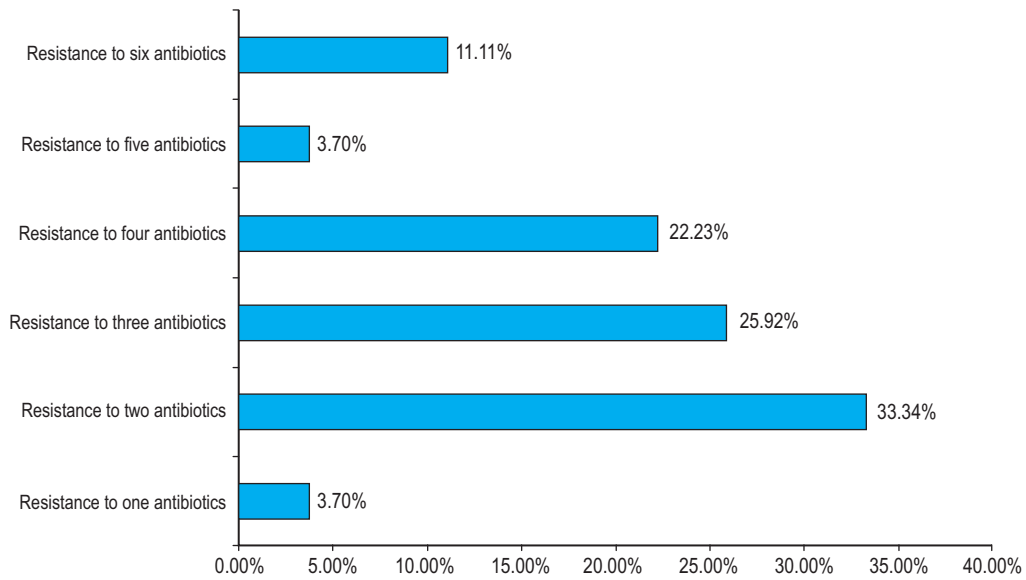


Fig. 3: Multiple Drug Resistance of *E. coli*.

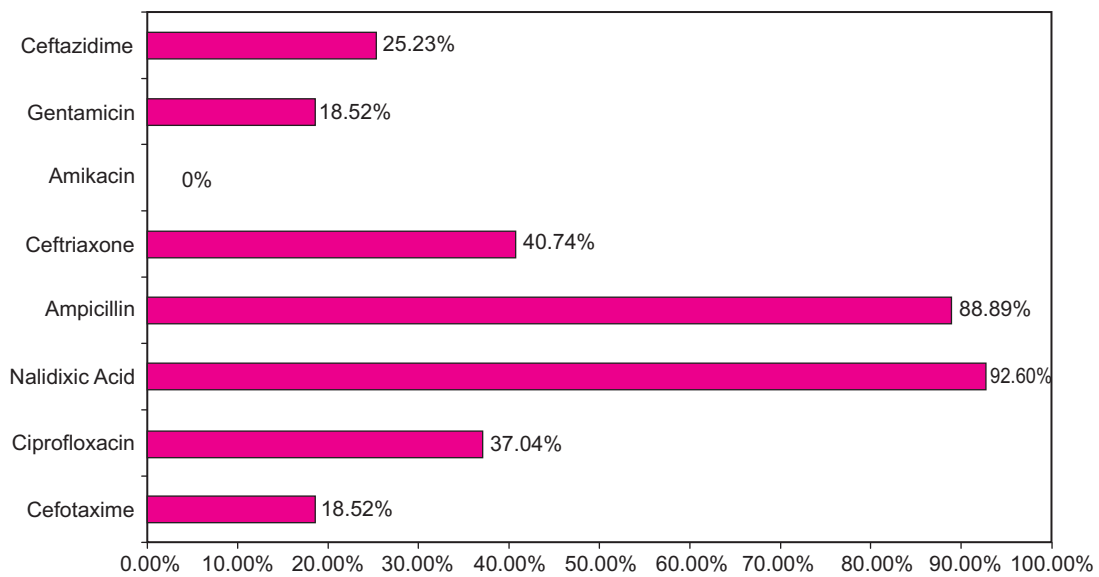


Fig. 4: Percentage of resistance against different antibiotics.

DISCUSSION

Since their discovery, antimicrobial drugs have been proved remarkably effective for the control of bacterial infections. However, it was soon evidenced that bacterial pathogens were unlikely to surrender unconditionally, and some pathogens rapidly became resistant to many of the first effective drugs.¹²

Over the past few decades, antimicrobials have become increasingly available for a broad range of pathogens. Due to the widespread use of these drugs, new forms of antimicrobial resistance have emerged.¹³

Antibiotic resistance profile for clinical *E. coli* isolates have well been documented by various workers. Opportunistic pathogens presenting broad-spectrum antibiotic resistance have emerged extensively in hospital environments, causing serious infections in immunocompromised hosts.¹⁴ However, less attention is given to environmental *E. coli* isolates.

Almost same results for *E. coli* strains isolated from drinking water have been reported by Walia SK in 2004.⁹

CONCLUSION

Drinking water in Hyderabad is heavily contaminated with potentially pathogenic multi drug resistant strains of *E. coli*.

The source could possibly be the mixing of sewage lines with drinking water supply. Presence of multi drug resistant *E. coli* in drinking water can act as a vehicle to disseminate antibiotic resistance to other bacteria. This suggests a need to educate people regarding the rational use of antibiotics and safe disposal of antibiotic containing waste.

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