

The Study of Multidrug Resistance Escherichia Coli in Drinking Water Samples from 3rd, 5th and 11th Districts of Kabul City

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Running Title: *The study of multidrug Escherichia Coli in Drinking water Samples from 3rd, 5th and 11th districts of Kabul city.*

Abstract: *Antibiotic resistance in pathogenic Bacteria is a serious public health issue. Various factors contribute to the spread of antibiotic –resistance micro organisms in the environment. This study was aimed for detection of multi drug resistance Escherichia Coli in drinking water samples from 3rd, 5th and 11th districts of Kabul city. This study was done in Descriptive Cross Sectional method during January upon December of 2019. Water sample is taken in Simple Random Sampling. The population size of drinking water sampling is N=378 and by using of Epi – info programme, the water sample is selected and so, the sample size of water sample is 378 samples, therefore 126 water sample from house hold ,126 samples from supplies and 126 samples from collection tankers of 3rd, 5th and 11th districts of Kabul city{Tables 1,2 ,3}. 126 Samples of drinking water from districts 3,5 and 11th of Kabul city were collected in a sterile bottle from various parts of each district of Kabul city bringing into Microbiology Department and growing it in mac-conkey agar {Tables 4,5 ,6 }. the collected data is by using of MS –excel and SPSS software was analyzed and Statics tests were established upon them. out of 378 samples collected in 243 (64.3%) Escherichia coli were isolated and 135(35.7%) samples were free of E.coli. Maximum resistance was observed against Nalidixic acid(64.3%) followed by ampicilline(59.5%), Ciprofloxacin,(57.1%) and gentamycine (5.7%) and ceftriaxone(4.7%). It is also remarkable that percentage of Escherichia coli in different sources of 3rd, 5th and 11th districts of Kabul city such as house hold, supplies and collection tanker was as follows: 16.6%, 19% and 28.57% { Tables 7,8,9 ,10}. In this study it was found, that contaminated percentage of drinking water in 3rd, 5th and 11th district of Kabul city was relatively low than other Asian and African countries. The cause of its contrast may be due to sample size differene and aslo detection of multidrug resistance Escherichia coli could be different from one country into another country.*

Keywords: Drinking water, Escherichia coli, antibiotic resistance, multidrug resistance, 3rd, 5th and 11th districts of Kabul city.

1. Introduction

Antibiotic resistance in pathogenic Bacteria is a serious public health problem. Various factors contribute to the spread of antibiotic–resistance microorganisms in the environment. Faecal coli forms 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 coli forms that contaminate the drinking water from human and animal fecal waste. During rainfalls, these coli forms 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, 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 infections, 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 gastrointestinal 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, Amoxycillin, 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 availability of antibiotic resistant E. coli strains in water cannot be denied. The multi-drug resistant (MDR) E. coli strains in drinking water have been reported by Walia SK.⁶ Our study is aimed for detection of multi drug resistance Escherichia Coli in drinking water samples (household, supplies and collection tanker) of three districts of Kabul city.

2. Review Literature

Escherichia coli is normal flora of human gastrointestinal system and is isolated from stool of humans.¹⁵ Escherichia coli is one of the most common bacteria which cause diarrhea in humans. Pathogenic species of Escherichia Coli

which are included enter pathogenic *Escherichia coli*, enterotoxigenic *Escherichia coli*, enteroinvasive *Escherichia coli* and enteroaggregative *Escherichia coli*, they could cause diarrhea.¹⁶ enterotoxigenic *Escherichia coli* are present in food and water resources of developing countries and it also caused diarrhea among children under age of two years in developing countries. Approximately a healthy person swallows 10^8 up to 10^{10} enterotoxigenic *Escherichia coli*, it could cause diarrhea.¹⁷ Also enterotoxigenic *Escherichia coli* among those passengers which are traveling to tropical and subtropical countries and faced into contaminated food and water, it may cause diarrhea. Moreover, enterotoxigenic *Escherichia coli* also may be one of bacterial cause of diarrhea in developed countries of the world.^{18,19} *Escherichia coli* could easily grow under aerobic conditions and on mac-conkey agar and could produce pink colony and it shows that *Escherichia coli* ferments glucose. The most significant chemical reaction for identification of *Escherichia coli* is indole test and at 99% it is indole positive.²⁰ A lot of research studies have been conducted to identify the multidrug resistance *Escherichia coli* in drinking water. One study which has been conducted in drinking water of Alhasa region of Saudi Arabia in 2010, it shows that contamination percentage of drinking water with *Escherichia coli* is 86.7%. As 57.7% of isolated *Escherichia coli* is at least resistant against three antimicrobial drugs such as Ampicillin, Nalidixic acid and Ciprofloxacin and 42.3% of isolated *Escherichia coli* is resistant against one or more than one antimicrobial drugs.²¹ Moreover, a study in Meso state of India in 2016, shows that 54% of isolated *Escherichia coli* in drinking water is resistant against antimicrobial drugs, 16% of isolated *Escherichia coli* in drinking water has intermediate effect against antimicrobial drugs and 30% of isolated *Escherichia coli* is sensitive against antimicrobial drugs.²²

Problem statement, Questions and Tentative Hypothesis

Water is a basic requirement of life and health and a basic nutrient of the human body. Water related diseases continue to be one of the major health problems globally. Everyday water related diseases cause the death of thousands of children, untold sufferings and loss of working time. About 4 billion cases of diarrhea occur annually worldwide of which 88% is attributed to unsafe water supply, inadequate sanitation and hygiene. Kabul city is the capital and most populated city in the country. The estimated population of Kabul city is approximately five million. This city has been facing different challenges like overgrowing population and rapid urbanization. Situations of water and environmental sanitation and hygiene have deteriorated in the city; Kabul city was initially designed for the population of one million but is now home to population around four million.

Hypothesis

The Contamination level with multi- drug resistant *E. Coli* is high among different sources of water in Kabul city.

Research Questions

- 1) What is the percentage of Multi drug resistance *Escherichia coli* in drinking water of Districts 3, 5 and 11 of Kabul city?

- 2) The Multi drug resistance *Escherichia coli* is resistant against which antimicrobial drugs?

Research Objectives

- 1) This study is aimed to detect multi drug resistance *Escherichia coli* in drinking water samples (household, supplies and collection tanker) of three districts in Kabul city.
- 2) To identify whether there exists any difference regarding water contamination between different districts and different sources of water.

By using the convenient sampling method, using Epi-Info programme, when confidential interval is 95%, $d=5\%$ and $p=50\%$ the sample size of water sample is 378 samples, from household supplies and from collection tankers.

Inclusion criteria

Drinking water of household, water supply and collection tanker of three districts of Kabul city.

Exclusion criteria

Drinking water of other sources of all districts of Kabul city. Samples of drinking water will be collected in a sterile bottle from various locations of Kabul city. Immediately the water sample would be brought to Microbiology Department and growing it in mac-conkey agar. The collected data would be analyzed is by using of Ms Excel and SPSS software and the results will be reported accordingly.

Research methodology

This study will be an Analytical Cross Sectional study and hope to be completed during eighteen months after approval. Water sample would be taken using Simple Random Sampling method from three districts. Three districts of Kabul city would be selected using the convenient sampling method, using Epi-Info programme, when confidential interval is 95%, $d=5\%$ and $p=50\%$ the sample size of water sample is 378 samples, from household supplies and from collection tankers.

Inclusion criteria

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3. Result

Out of 378 samples collected in 243 (64.3%) *Escherichia coli* were isolated and 135(35.7%) samples were free of *E.coli*. Maximum resistance was observed against Nalidixic acid (64.3%) followed by ampicilline (59.5%), Ciprofloxacin, (57.1%) and gentamycine (5.7 %) and ceftriaxone (4.7%). It is also remarkable that percentage of *Escherichia coli* in different sources of 3rd, 5th and 11th

districts of Kabul city such as house hold, supplies and collection tanker was as follows:16.6%,19% and 28.57% {Tables7,8,9 ,10}.

in this study it was found, that contaminated percentage of drinking water in 3rd, 5th and 11th district of Kabul city was relatively low than other Asian and African countries. The cause of its contrast may be due to sample size difference and aslo detection of multidrug resistance Escherichia coli could be different from one country into another country.

4. 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 drugs²³. 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 emerged²⁴. 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 hosts²⁵. 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 .

5. Conclusion

In this study it was found that contaminated percentage of drinking water in 3rd, 5th and 11th districts of Kabul city was relatively lower than other Asian and African countries. The cause of its contrast may be due to sample size difference and aslo detection of multidrug resistance Escherichia coli could be different from one country into another country.

Table(1).show the different sources of drinking water in district 3rd of Kabul city.

Water Source	Frequency	Percentage	Total Percentage
House Hold	42	33.3%	33.3%
Supplies	42	33.3%	33.3%
Collection Tankers	42	33.3%	33.3%
Total	126	100%	100%

Table(2).show the different sources of drinking water in district 5th district of Kabul city.

Water Source	Frequency	Percentage	Total Percentage
House Hold	42	33.3%	33.3%
Supplies	42	33.3%	33.3%
Collection Tankers	42	33.3%	33.3%
Total	126	100%	100%

Table 3: Show the different sources of drinking water in district 11th district of Kabul city.

Water source	Frequency	percentage	Total percentage
house hold	42	33.3%	33.3%
Supplies	42	33.3%	33.3%
collection tankers	42	33.3%	33.3%
Total	126	100%	100%

Table 4: Show the percentage of E.coli in drinking Water of district 3rd of Kabul city

The presence of E.coli in drinking water	Frequency	Percentage	Total percentage
Yes	81	64.3%	64.3%
No	45	35.7 %	35.7 %
Total	126	100%	100%

Table 5: Show the percentage of E.coli in drinking Water of district 5th of Kabul city

The presence of E.coli in drinking water	Frequency	Percentage	Total percentage
Yes	81	64.3%	64.3%
No	45	35.7 %	35.7 %
Total	126	100%	100%

Table 6: Show the percentage of E.coli in drinking Water of district 11th of Kabul city.

The presence of E.coli in drinking water	Frequency	Percentage	Total percentage
Yes	81	64.3%	64.3%
No	45	35.7 %	35.7 %
Total	126	100%	100%

Table 7: Show the percentage of E.coli in different sources drinking water of 3rd district of Kabul city

The percentage of E.coli in house hold source	27.1% (22 samples)
The percentage of E.coli in supplies sources	30.87% (25 samples)
The percentage of E.coli in collection tanker	41.98% (34 samples)

Table 8: Show the percentage of E.coli in different sources drinking water of 5th district of Kabul city

The percentage of E.coli in house hold source	27.1% (22 samples)
The percentage of E.coli in supplies sources	30.87% (25 samples)
The percentage of E.coli in collection tanker	41.98 (34 samples)

Table 9: Show the percentage of E.coli in different sources drinking water of 11th district of Kabul city

The percentage of E.coli in house hold source	27.1% (22 samples)
The percentage of E.coli in supplies sources	30.87% (25 samples)
The percentage of E.coli in collection tanker	41.98% (34 samples)

Table 10: Show the Result of Antibiogram of different Antibiotics for drinking water of 3rd, 5th and 11th districts in Kabul city.

Antibiotics	Frequency	Percentage	Total percentage
Nalidixic acid Resistance	81	64.3%	100%
Ampicilline Sensitive Resistance	2 79	4.8 % 59.5%	7.4% 92.6%
Ceftriaxone Sensitive Resistance	79 2	59.5% 4.7%	92.6% 7.4%
Ciprofloxacin Sensitive Resistance	3 78	7.1% 57.1%	11.1% 88.9%

Ceftazidime Sensitive Resistance	81 .	64.3% 0%	100% 0%
Cefotaxime Sensitive Resistance	81 .	64.3% 0%	100%
Gentamycine Sensitive Resistance	36 45	30.9% 35.7%	11.1% 88.9%
Amikacine Sensitive Resistance	81 .	64.3% 0%	100% 0%
Total		126	

6. Conflict of interest

The authors have no conflict of interest.

Note: To whom it may concern:

The Authors are submitting this article to international journal of Science and Research from Afghanistan.

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