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The study of multidrug resistance *Escherichia coli* in drinking water samples from 12 district of Kabul city

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Abstract
Antibiotic resistance in pathogenic Bacteria is a serious public health issue. Various factors contribute to the spread of antibiotic-resistance microorganisms in the environment. This study was aimed for detection of multi drug resistance *Escherichia coli* in drinking water samples from 12th district of Kabul city. Water sample is taken in Simple Random Sampling. The population size of drinking water sampling is N=378 and by using of Epi – info program, 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 12th district of Kabul city. Samples of drinking water from district 12th of Kabul city were collected in a sterile bottle from various parts of district 12th of Kabul city bringing into Microbiology Department and growing it in mac-conkey agar. The collected data is by using of MS-excel and SPSS software was analyzed. 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%. It is also remarkable that percentage of *Escherichia coli* in different sources of 12th district of Kabul city such as house hold, supplies and collection tanker was as follows: 27.1%, 30.8% and 41.9%%. In conclusion this study found that contaminated percentage of drinking water in 12th district of Kabul city was higher 64.3% and presence of *E. coli* is higher in tanker collection and antibiotic resistance is higher against Nalidix acid. Further studies is needed for better results in future.

Keywords: drinking water, *Escherichia coli*, antibiotic resistance, multidrug resistance, 12th district of Kabul city

Introductions
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 district 12th of Kabul city.

Review Literatures

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 108 up to 1010 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.21Moreover, a study is 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 District 12th 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 district 12th in Kabul city.
2. To identify whether there exists any difference regarding water contamination of district 12 th of Kabul city and different sources of water.

Inclusion criteria

Drinking water of household, water supply and collection tanker of district 12th of Kabul city.

Exclusion criteria

Drinking water of other sources of other districts of Kabul city.

Methods and Materials

This study is a descriptive Cross Sectional done in spring of 2021 (March–April-May). Water samples were taken using Simple Random Sampling method from District 12th of Kabul city were selected by using the convenient sampling method, from water sources of household, suppliers and from collection tankers.

The population size of drinking water sample is N=378 and by using of Epi – info program, 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 suppliers and 126 samples from collection tankers of 12th district of Kabul city

Samples of drinking water will be collected in a sterile bottle from various locations of 12 district 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 by using of Ms Excel and SPSS software.

Results

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 ceftriaxone (59.5%).It is also remarkable that percentage of *Escherichia coli* in different sources of 12th district of Kabul city such as house hold, supplies and collection tanker was as follows: 27.1%, 30.8% and 41.9%. In this study it was found, that contaminated percentage of drinking water in 12th district of Kabul city was higher. Tables (2, 3, 4).

Table 1: Show the different sources of drinking water in district 12th of Kabul city

Water source	Frequency	Percentage	Total percentage
House hold	126	33.3 ٪	33.3 ٪
Supplies	126	33.3 ٪	33.3 ٪
Collection Tankers	126	33.3 ٪	33.3 ٪
Total	378	100 ٪	100٪

Table 2: Show the percentage of *E. coli* in drinking Water of district 12th of Kabul city

The presence of *E. coli* in drinking water	Frequency	Percentage	Total percentage
Yes	243	64.3%	64.3%
No	135	35.7%	35.7%
Total	378	100%	100%

Table 3: Show the percentage of *E. coli* in different sources drinking water of 12th 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 4: Show the Result of Antibiogram of different Antibiotics for drinking water of 12th district in Kabul city.

Antibiotics	Frequency	Percentage
Nalidixic acid Resistance	81	64.3%
Ampicilline Sensitive Resistance	79	59.5%
Ceftriaxone Sensitive Resistance	79	59.5%
Ciprofloxacin Sensitive Resistance	78	57.1%

Discussions

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 [23].

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 [24]. 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 [25]. 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.

Conclusion

In this study it was found that contaminated percentage of drinking water in 12th district of Kabul city was higher 64.3% and presence of *E. coli* is higher in tanker collection and antibiotic resistance is higher against Nalidix acid. Further studies is needed for better results in future.

Conflict of interest

The authors have no conflict of interest.

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