

Antibiotic susceptibility patterns of *E. coli* isolated from water and stool samples in Mthatha region eastern cape province of South Africa

Abstract

Objective: To determine the antibiotic susceptibility patterns of *E. coli* isolated from water and stool samples.

Materials and methods: A study was undertaken to determine the antibiotic susceptibility patterns of *E. coli* isolated from water and stool samples submitted to Mthatha Government hospital from January 2012-December 2012.

Results: A total of 500 water samples and 150 stool samples were screened for *E. coli*. *E. coli* was found in 80% of the water samples and 32% of the stool samples. Of the water samples, 40% were of the isolated strains was β -Lactamase positive and 21% from the stool strains respectively. The non β -lactamase producing isolates were susceptible to most of the antibiotics including meropenem, imipenem, ciprofloxacin and gentamicin. The ESBL strains were only susceptible to meropenem, imipenem, ciprofloxacin and gentamicin. Table 1 shows the comparisons of the susceptibility profiles of *E. coli* from water and stool samples. The results show a similar pattern in susceptibility profile of strains from water and stool samples.

Conclusion: The results implicate a cross contamination of water sources by faecal material or that the population is drinking contaminated water. This requires further Phylogenetic analysis of the strains.

Keywords: antibiotic susceptibility, *E. coli*, colilert method, phylogenetic analysis, HIV infections

Introduction

The emergency and spread of multi-drug resistant enteropathogens has become a major concern among public health officials and the public at large due to the changes in the genomic characteristics of bacterial pathogens. According to Obi et al.¹ antibiotics are known to shorten the duration of diarrhea, decrease stool output and reduce some complications caused by diarrhea.

Enteric bacteria are one of the organisms associated with diarrheal infections due to contaminated water sources and *Escherichia coli* is the most troublesome in the group.² It is also used as an indicator organism in assessing faecal contamination of water sources. The major striking epidemiological feature is the low number of bacteria that may trigger disease, as one needs some 100 cells of *E. coli* to cause a clinical illness compared to *Salmonella*(10⁷-10⁸ cells).³

E. coli has been reported as an emerging infection due to HIV infections.^{4,5} Previously, *E. coli* was mainly associated with infantile diarrhea and it would be excluded if isolated from an adult who has diarrhea, laboratories would not do any further test or carry out the antibiogram, but recently, reports have shown that an ESBL strain has emerged and it has proven to be very difficult to eradicate using the β -lactams and there is therefore need to analyse and identify the strains from the stools before ruling it out as insignificant.⁶

Studies over the past few years have documented that *E. coli* and in particular ETEC is usually a frequent cause of diarrhea in infants younger than 2 years. In some African countries, it was found to be the

most common cause of diarrhea with 70% of infants accounting for most of the infections, while males were more infected than females.⁶

Of the six seropathogens, VTEC is associated with ruminant animal in particular cattle thus contaminated beef becomes the source of human infections. However, a wide variety of the other sources have been implicated, ranging from unpasteurized milk, cheese, beef, mushrooms, sprouts and salami.⁷ Water born transmission occurs through swimming in contaminated lakes, pools, or drinking untreated water.

Direct contact with animal faecal material through recreational activities and also person-person contact. EIEC, EPEC and DAEC are mainly linked to contaminated water and food, with the most common foods associated with hamburger meat and unpasteurized milk, while EAEC is mainly associated with infant foodstuffs and formulae, milk and water are also implicated.

Material and methods

Water samples were collected from January-October 2012 from different water sources around Mthatha and surrounding towns and villages. Stool samples were those submitted to NHLS Mthatha from Jan-October 2012.

Culture and isolation

Colilert method involving the screening of faecal contamination and selective media and 20E API biochemical test were used as they are the methods used in the NHLS Mthatha. Positive water samples were then cultured onto Mac Conkey agar at 37°C over night.

Stool samples were inoculated onto DCA at 37°C for 24hrs and then lactose fermenting colonies were picked and sub cultured onto Mac Conkey Agar. Colonies from both water and stool samples were inoculated onto the 20E API strip for biochemical test and incubated over night and the results were read using the API reader. β -lactamase strips were used to screen for ESBL strains on all the colonies and serological tests were done to identify the six seropathogens of *E. coli*.

Results

Of the 500 water samples, 80% had *E. coli* and 40% were ESBL positive, while of the 150 stool samples, 32% had *E. coli* and 21% were ESBL positive. The non β -lactamase producing isolates were susceptible to most of the antibiotics including meropenem, imipenem, ciprofloxacin and gentamicin. The ESBL strains were only susceptible to meropenem, imipenem, ciprofloxacin and gentamicin. Table 1 shows the comparisons of the susceptibility profiles of *E. coli* from water and stool samples and ESBL strains. The results show a similar pattern in susceptibility profile of strains from water and stool samples (Figure 1).⁸

Table 1 Susceptibility profile of *E. coli* strains from water and stool samples

	Water	Stool	ESBL
Antibiotics	N=400	N=48	N=170
Ampicillin	240	38	0
Gentamicin	400	48	170
Ciprofloxacin	400	48	170
Imipenem	400	48	170
Cotrimoxazole	240	20	0
Tazo/piperacillin	200	38	5
Cefoxitin	240	38	20
Tobramycin	240	38	0

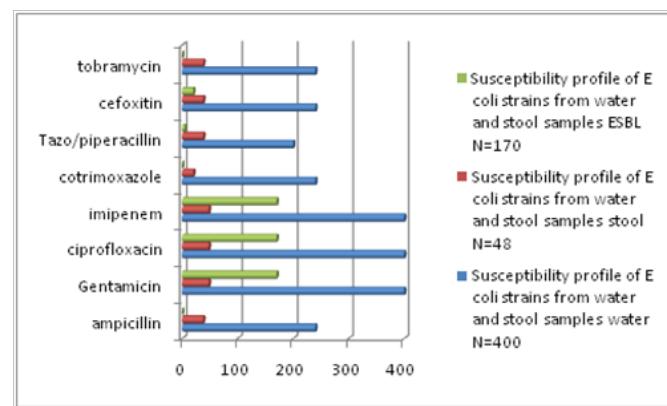


Figure 1 Susceptibility profile of *E. coli* strains from water and stool samples.

Conclusion and recommendations

The resistance of ESBL was significant at an average of 80%. Of special note is the similarity in the antibiogram profile of isolates from water and stool samples from this population. This could indicate a cross contamination of water sources or the community is drinking from contaminated water sources. From this study, there is need for further work to check the Phylogenetic and phenotypic characteristics of these strains in order to check the link.

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None.

Conflict of interest

The author declares no conflict of interest.

References

- Obi CL, Ramalivhana J, Momba MNB, et al. Antibiotic resistance profiles and relatedness of enteric bacterial pathogens isolated from HIV/AIDS patients with and without diarrhoea and their household drinking water in rural communities in Limpopo Province South Africa. *African Journal of Biotechnology*. 2007;6(8):1035–1047.
- Qadri F, Svennerholm A, Faruque ASG, et al. Enterotoxigenic *Escherichia coli* in developing countries: epidemiology, microbiology, clinical features, treatment, and prevention. *Clin Microbiol Rev*. 2005;18(3):465–483.
- Taylor DN, Gardner P, Nichols RL, et al. Infectious Diseases. *National foundation of infectious diseases*. 2003;6(1):1–6.
- Chikwelu LO, Natasha P, Pascal OB. *Enteric pathogens in water sources and stools of residents in the Venda Region of the Limpopo province*. South Africa: Water research commission report, University of Venda for Science and Technology; 2005.
- Uppal B, Kashyap B, Bhalla P. Enteric pathogens in HIV/AIDS from a tertiary care hospital. *Indian J Community Med*. 2009;34(3):237–242.
- Sivri N, Seker DZ. Investigation of enteric bacteria of surface waters in the southwestern coast of Istanbul by means of GIS. *Turkish Journal of Fisheries and Aquatic Sciences*. 2010;10(4):505–511.
- Sears CL, Kaper JB. Enteric bacterial toxins: mechanisms of action and linkage to intestinal secretion. *Microbiol Rev*. 1996;60(1):167–215.
- World Health Organization (WHO). *WHO Global Foodborne Infections Network*. Switzerland: Geneva; p. 1–45.