

Profiles of antibiotic susceptibilities of bacterial isolates and physico-chemical quality of water supply in rural Venda communities, South Africa

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Abstract

The Venda region of South Africa is predominantly rural and residents rely on untreated water sources for daily water needs. The physico-chemical quality of these water sources including antibiotic susceptibilities of enteric bacterial isolates which would guide clinicians in the empiric management of diarrhoea have received cursory attention. This study therefore sought to document the physico-chemical parameters and antibiograms of bacterial isolates from water sources in order to determine the safety for human consumption and to provide updated antibiotic data for empiric treatment of patients. Water samples were obtained on a weekly basis from Ngwedi, Mutale, Tshinane, Mutshindudi and Mudawali Rivers and Makonde, Mudawali and Thamathama Fountains between August 2000 and July 2002. Physico-chemical parameters such as turbidity, temperature, pH, lead, fluoride, cyanide, iron, sulphate, chromate and nitrate were determined. Antibiograms of bacterial isolates were ascertained using the disk diffusion method.

Results obtained revealed that all the physico-chemical variables of the water sources analysed were within normal recommended limits for safety of drinking water except for turbidity, which exceeded recommended limits and hence precludes the rivers from direct domestic use.

Antibiogram profiles showed multiple antibiotic resistances of *Salmonella*, *Shigella*, *Campylobacter*, *Aeromonas*, *Vibrio cholerae*, *Enterobacter* and *Plesiomonas* to ampicillin, tetracycline, chloramphenicol, cotrimoxazole and erythromycin. In contrast virtually all the enteric bacterial isolates showed marked susceptibilities to ciprofloxacin, nalidixic acid, gentamicin, ceftriazone and amikacin. These effective antibiotics are therefore indicated in the empiric treatment of diarrhoeal cases or water-borne diseases of bacterial aetiology.

Keywords: water quality, microbial, physico-chemical, antibiograms, enteric bacteria, rural communities, Venda region

Introduction

The multifarious uses of water for drinking, bathing, washing and cooking are well known. Water meant for human consumption should be free from pollution, safe and acceptable. Indeed, the microbial quality of water sources should not exceed the maximum limits specified in the water quality guidelines (DWAf, 1996; WRC, 1998). However, the microbial quality of river water sources in rural communities in the Venda region, Limpopo Province, South Africa have been reported to be poor, unsafe and not acceptable for human consumption (Obi et al., 2002). Several bacterial enteropathogens namely *Campylobacter jejuni/coli*, *Salmonella*, *Shigella*, *Plesiomonas*, *Aeromonas*, *Vibrio cholerae* and *Escherichia coli* were also isolated from the river water sources (Obi et al., 2002). These enteric bacterial pathogens are variously incriminated in cases of diarrhoea, which accounts for a substantial degree of morbidity and mortality in different age groups worldwide (Black, 1993; Nath et al., 1993; Pracho and O’Ryan; 1994, Obi et al., 1997, 1998; El-Sheikh and El-Assouli, 2001).

Isolation of pathogens from water sources connotes a serious public health risk for consumers. To further compound this problem, enteric bacterial pathogens have been widely reported to demonstrate resistance to several antibiotics (Hoge et al., 1998; Obi

et al., 1998; McArthur and Tuckfield, 2000; Engberg et al., 2001; Ash et al., 2002). For example, in 1984, 82% of *Campylobacter* strains from Lagos, Nigeria, were sensitive to erythromycin, and 10 years later only 20.8% were sensitive (Coker and Adefeso, 1994). In Thailand, ciprofloxacin resistance among *Campylobacter* species increased from 0% before 1991 to 84% in 1995 (Hoge et al., 1998). Strains of *S. typhi* with multiple resistances to chloramphenicol, ampicillin and trimethoprim have led to several outbreaks (Rowe et al., 1997). In the United States, several rivers were reported to be reservoirs of antibiotic resistant bacteria (Ash et al., 2002). Antibiotic resistance may occur spontaneously, by selective pressure or because of antibiotic abuse by humans or over use in animals (White et al., 2000). Although antibiotic resistance is common, antibiotics are still indicated in the management of diarrhoea. Antibiotics shorten the duration of diarrhoea, decrease stool output and may mitigate complications (Black, 1993). However, in spite of the poor water quality in rural Venda region, data on antibiotic susceptibilities of bacterial isolates from river water sources are lacking. Such data, if available, will be useful in the empiric management of patients with diarrhoea in the region because antibiograms vary with time and geographical region.

Another gap in the corpus of research activities on water sources in the Venda region is the paucity of data on physico-chemical profiles, which are also indices of water quality. Monitoring of physico-chemical profiles is essential because of their effects on human health, when safety limits are exceeded (WRC, 1998). For example, chromium is associated with the occurrence of nasal

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