

## Public Health 2020: Microbiological analysis of environmental bacteria from surface and drinking water in Bakura, Bakura local government of Zamfara State Nigeria, and classification using their antibiotic resistance profiles - Habibu Kabiru - University of Wolver Hampton

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The aim of this research was to isolate and identify environmental bacteria from various raw water sources as well as the drinking water distributions system in Bakura, Zamfara State, Nigeria and to determine their antibiotic resistance profiles. Water samples from five different sites (raw and drinking water) were tested for the presence of faecal indicator bacteria as well as *Aeromonas* and *Pseudomonas* species. Faecal and total Coliforms were detected in the treated water samples from the Bakura's dam and in the mixed water samples, with *Pseudomonas* spp. being the most prevalent organism. The most prevalent multiple antibiotic resistance phenotype observed was KF-AP-C-E-OT-K-TM-A. All organisms tested were resistant to erythromycin, trimethoprim, and amoxicillin. All isolates were susceptible to ciprofloxacin and faecal Coliforms and *Pseudomonas* spp. to neomycin and slightly streptomycin. Cluster analysis based on the zone of inhibition diameter data shows that the isolates had similar chemical exposure histories. Isolates were identified using *gyrB*, *toxA*, *ecfX*, *arA*, and *hylH* gene fragments and *gyrB*, *ecfX*, and *hylH* fragments were amplified. These results demonstrate that (i) the drinking water from Bakura contain various bacterial species and at times faecal and total Coliforms. (ii) The various bacteria are resistant to various classes of antibiotics.

Water is considered a vehicle for the propagation and dissemination of human associated bacteria. Safe drinking water is a fundamental human right and if contaminated with opportunistic pathogenic environmental bacteria, it may have health implications for consumers. Human health should therefore be protected by preventing microbial contamination of water that is intended for consumption. In rural communities, untreated surface water from rivers, dams, and streams is directly used for drinking and other domestic purposes. These unprotected water sources can be contaminated with microbes through rainfall run-off and agricultural inputs, mixing with sewage effluents and faeces from wild life, which render them unacceptable for human consumption. Faecal coliforms, *Aeromonas* and *Pseudomonas*, are used as indicators of faecal contamination in water and the presence of these pathogens may have severe health implications on consumers especially those that are immunocompromised.

Water samples were collected from five sampling points around Mafikeng, namely, both raw and treated (drinking) water from a

karstic groundwater source, the Molopo Eye, both raw water and treated (drinking) water from the Modimola dam, and finally mixed water, treated water from both sources mixed in the Signal hill reservoir and distributed to some areas in the city. These sampling points were chosen for the study because water from Molopo eye and Modimola dam, after purification, is used for human consumption, and for recreational, agricultural, and industrial purposes. As few small scale of farmer's lives near these two water resources and the Modimola Dam receives treated sewage effluent from the Mmabatho sewage treatment plant, which is the major source of pathogens, it is therefore important to investigate the microbiological quality of water at these points.

An evaluation of the bacteriological quality of drinking water in the present study confirmed the presence of various bacterial species including opportunistic pathogens such as *Aeromonas* and *Pseudomonas* spp. These organisms were resistant to several classes of antibiotics. Undesirable properties of water quality caused by the presence of drug-resistant bacteria can pose a negative impact on human health.

The data on multiple antibiotic resistance (MAR) profiles of bacterial isolates from water and the resistance patterns of organisms in drinking water in Mafikeng suggested that there has been an indiscriminate use of the antibiotics tested. The high prevalence of multiple antibiotic-resistant organisms in the drinking water distribution system could potentially pose a threat to humans consuming this water. The presence of MAR organisms in the drinking water of Mafikeng, South Africa, is an important health concern due to the risk of developing waterborne diseases and the health risks associated with immunocompromised patients living in the area. It is therefore imperative to monitor the quality of water and strict quality control measures should be put in place to ensure the effective treatment of drinking water. Since the Modimola dam is the recipient of treated waste water as well as the water source for drinking water production, extremely strict measures should guide the waste water treatment plant. The quality of effluent leaving in this plant should be extremely high.

This would decrease the load of microorganisms allowed to enter the dam. Such measures will improve the overall quality of water available for drinking water production, preventing outbreaks and spreading water borne diseases. Antibiotic

resistance surveillance can be used as tool to control the problem of antibiotic resistance and to educate the public on the consequences of the misuse of antibiotics and also to regulate the usage of drugs in both human and veterinary medicine. It is also helpful to formulate guidelines for the optimal use of antibiotics. Further studies should be conducted to assess the level of antibiotics in water and the potential risks associated with human consumption of polluted water. It is also very important that findings from studies such as this one should be disseminated to the relevant stakeholders and the affected communities.