Cephalosporin resistance: A predominant antimicrobial resistance found in E. coli isolated from Vembanad and Sasthamkotta Lake, Kerala

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In recent years, antimicrobial resistance (AMR) has become a hazard to humans and other animals, and the health sector is now experiencing an upsurge in AMR in lakes and other water bodies which supply drinking water to the common public. Antimicrobials are employed in human health and animal agriculture; as a result, aquatic habitats become "a hot reservoir and carrier of AMR genes" (Watts et al. 2017).

Surveillance is an important aspect of any mitigation measures. The first step in controlling the growing AMR throughout the system is to produce evidence using a surveillance strategy. The Vembanad Lake in Kerala, India, is regarded as the longest Lake in India (96 km), as well as the largest Lake in the State. It is an open complex wetland system, and the lake receives water from six major rivers (Vaiyapuri et al., 2021). The Sasthamkotta is the largest freshwater closed lake in Kerala supplementing the drinking water needs of the Kollam region and hence ensuring the quality of the water assumes significance.

E. coli is regarded as the primary faecal indicator bacteria used to test the quality of food and water (Visnuvinayagam et al., 2017), and the AMR of *E. coli* is on the rise globally. This is a concern as more ESBL and carbapenemases are being produced with greater resistance. Therefore, evaluating these two aquatic bodies for both the microbiological quality and the AMR was deemed essential for determining the current state and creating mitigating plans.

A surveillance study was conducted across Vembanad Lake and Sasthamkotta Lake. For the Vembanad Lake, water samples (n=35) were drawn from different geographical locations over the entire 90Km stretch of the Lake. The antibiotic susceptibility test (AST) was performed on 116 *E. coli* isolated from 27 (77.1%) positive samples. For the Sasthamkotta Lake, water samples were collected from 16 sites using a Niskin water sampler machine. The water was directly collected in a sterile bottle and kept chilled until further laboratory use. *E. coli* was isolated from the water samples from 11 sites, and AMR was determined. The study has identified the prevalence of *E. coli* in both the lake water samples. The probability of isolating cephalosporin-resistant *E. coli*, particularly cefotaxime-resistant *E. coli*, was the highest in both the Lake.

The two most dangerous resistances emerging in cephalosporin medicines are extended spectrum beta lactamases (ESBL) and carbapenem resistance. Cephalosporin resistance including ESBL E. coli was reported in the first surveillance study at Vembanad Lake, Kerala (Vaiyapuri et al., 2021), rivers and lakes in Northwest China (Liu et al., 2018), rivers and lakes in Switzerland (Zurfluh et al., 2013), Jurong Lake, Singapore (Zhong et al., 2021), urban lakes and reservoirs in Southeastern Brazil (Nascimento et al., 2017). Cephalosporin resistance, particularly third and fourth generation cephalosporin resistance, is already recognised as a hazard to the public health system, and this issue has been observed in other sectors such as food animal production and the environment.

The study indicates that more cephalosporin antibiotics are being used across sectors, and finally, the water bodies are at the receiving end. In the one health context of mitigation measures for AMR, enough emphasis should be given to the environmental component of one health.

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