

Dissemination of extending-spectra lactamase E. coli carrying multidrug resistance and virulence factors in tropical rivers receiving hospital effluents

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Abstract

E. coli are gastrointestinal inhabitants of warm-blooded animals used as indicators of microbial quality of surface water. Beside the apathogenic commensal representatives, certain strains are highly pathogenic. The contamination of drinking and recreational waters by E. coli pathotype (i.e. EHEC, STEC, ETEC) are associated with numerous water borne diseases whose symptoms include water diarrhoea, fever, vomiting indeed meningitis. This situation is particularly alarming in developing countries in which the poor water quality continues to pose a serious threat to human health in reason of the broad contamination of freshwater resources by various organic and inorganic pollutants, including antibiotic resistant bacteria and their resistance genes due to the important discharge of untreated urban, industrial and agricultural wastewater. The aim of this research is to assess the role of untreated hospital and urban wastewaters on the biological contamination of urban rivers receiving systems in the city of Kinshasa, Republic Democratic of Congo. 147 E. coli strains resistant to 3rd generation of β -lactams (ESBL) were isolated from water samples issued along 5 rivers receiving hospital effluents. They were analysed for their clonality and the carriage of multidrug resistance and virulence genes. The results highlight a high level of clonality in strains (67 clones) and an important level of multidrug resistance regardless the sampling point. 53% of E. coli resistant to the 3rd generation of β -lactams were also resistant between 6 to 8 antibiotics. 14% of ESBL producers also carried virulence genes factors linked to E. coli pathotype determination. The genes eaeA, ST, LT and aggR were carried by 1.3%, 5.4%, 2.7% and 6.8% of the strains. These results indicate the human and environmental potential risk of tropical urban rivers. Indeed, ESBL strains carried by urban rivers are associated to resistance against numerous antibiotic classes and may also carry virulence genes factors. The presence of multi-drug resistant E. coli are not intimately linked to untreated hospital wastewater discharge in urban receiving system and are widely distributed along

the river, thus highlighting the risk of surface water use.

Escherichia coli also known as E. coli is a Gram-negative, facultative anaerobic, rod-shaped, coliform bacterium of the genus Escherichia that is commonly found in the lower intestine of warm-blooded organisms (endotherms). Most E. coli strains are harmless, but some serotypes (EPEC, ETEC etc) can cause serious food poisoning in their hosts, and are occasionally responsible for food contamination incidents that prompt product recalls. The harmless strains are part of the normal microbiota of the gut, and can benefit their hosts by producing vitamin K₂, (which helps blood to clot) and preventing colonisation of the intestine with pathogenic bacteria, having a symbiotic relationship. E. coli is expelled into the environment within fecal matter. The bacterium grows massively in fresh fecal matter under aerobic conditions for 3 days, but its numbers decline slowly afterwards.

E. coli and other facultative anaerobes constitute about 0.1% of gut microbiota, and fecal-oral transmission is the major route through which pathogenic strains of the bacterium cause disease. Cells are able to survive outside the body for a limited amount of time, which makes them potential indicator organisms to test environmental samples for fecal contamination. A growing body of research, though, has examined environmentally persistent E. coli which can survive for many days and grow outside a host.

The bacterium can be grown and cultured easily and inexpensively in a laboratory setting, and has been intensively investigated for over 60 years. E. coli is a chemoheterotroph whose chemically defined medium must include a source of carbon and energy. E. coli is the most widely studied prokaryotic model organism, and an important species in the fields of biotechnology and microbiology, where it has served as the host organism for the majority of work with recombinant DNA. Under favorable conditions, it takes as little as 20 minutes to reproduce. E. coli includes a colossal populace of microbes that show a serious extent of both hereditary and phenotypic decent variety. Genome sequencing of many disengages of E. coli and related microscopic organisms shows that an ordered renaming would be attractive. In any case, this has not been done, to a great extent because of its clinical significance, and E. coli stays

one of the most assorted bacterial species: just 20% of the qualities in a run of the mill *E. coli* genome is shared among all strains. Truth be told, from the more productive perspective, the individuals from variety *Shigella* (*S. dysenteriae*, *S. flexneri*, *S. boydii*, and *S. sonnei*) ought to be delegated *E. coli* strains, a marvel named taxa in mask. Likewise, different strains of *E. coli* (for example the K-12 strain generally utilized in recombinant DNA work) are adequately unique that they would justify renaming. A strain is a subgroup inside the animal types that has one of a kind qualities that recognize it from different strains. These distinctions are frequently recognizable just at the atomic level; notwithstanding, they may bring about changes to the physiology or lifecycle of the bacterium. For instance, a strain may increase pathogenic limit, the capacity to utilize a one of a kind carbon source, the capacity to take upon a specific environmental specialty, or the capacity to oppose antimicrobial operators. Various strains of *E. coli* are frequently have explicit, making it conceivable to decide the wellspring of fecal pollution in ecological examples. For instance, knowing which *E. coli* strains are available in a water test permits scientists to make presumptions about whether the defilement started from a human, another warm blooded creature, or a fowl.