Quantitative microbial risk assessment as a tool for groundwater monitoring. A case study in the rural communities of Romania

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Abstract

Karst springs are an essential source of drinking water in rural communities in North-Western Romania. Due to the fractured dolomite aquifers, dolines, or blind valleys, these springs are vulnerable to contamination by human and zoonotic pathogens. In this study, we assessed the human health risk associated with the contamination of six springs’ water with gastrointestinal pathogens. The data on the occurrence of E. coli and estimated Campylobacter and Rotavirus for a year of monitoring from twenty-four samples were inputted into a Quantitative Microbial Risk Assessment (QMRA) model (Machdar et al. 2013). The QMRA was conducted following steps: hazard identification, dose-response assessment, exposure assessment, and risk characterization (Haas C N et al. 2014; World Health Organization 2016). In order to predict the total cases of illnesses for the spring water consumers, the probability of infection and illness was calculated for adults and children. Results have shown that the estimated probability of infection for enteropathogenic E. coli, Campylobacter, and Rotavirus ranged between 1.1 × 10⁻³ and 1.0 × 10⁻⁰, values much higher than the acceptable limit of 10⁻⁴ infections/person/year established by WHO (2016). The estimated probability of illness due to the pathogenic E. coli and Campylobacter infection was high, with values between 8.8 × 10⁻² and 3.5 × 10⁻¹ for five out of six groundwater sources. The estimated probability of illness due to the
Rotavirus infection ranged between $4.0 \times 10^{-4}$ and $6.4 \times 10^{-2}$ for both adults and children. The finding suggests that consuming contaminated spring water could lead to severe acute, chronic, or sometimes fatal health consequences for the locals. This study provides valuable QMRA information on the contaminated karst groundwater, with important implications for human health and groundwater resources management.

**Keywords**

karst springs, Quantitative Microbial Risk Assessment (QMRA), *E. coli*, *Campylobacter*, *Rotavirus*, rural communities, drinking water

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**Conflicts of interest**

None declared.
References

