

Relevanz von Legionellen im kommunalen Wasserverteilungsnetz Nr. 4.22.02

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Key words

Legionella, *L. pneumophila*, water distribution network, PCR, amoeba plate test, ISO 11731

Aim of the study

In general, the health risk due to *Legionella* bacteria potentially occurring in the water distribution network should be assessed as a basis for deciding, whether measures for *Legionella* prevention need to be taken by the water suppliers. The specific aims of the project were the following:

- a) Detection, quantification and differentiation of *Legionella* in the water distribution network
- b) Assessment whether *Legionella* can multiply in the water distribution network
- c) Determination of the pathogenicity of *Legionella* in the distribution network
- d) Epidemiological relevance of *Legionella* from the distribution network
- e) Establish and optimize an amoeba plate test for the detection of *Legionella* species

Material and methods

- PCR
- Amoeba plate test
- ISO 11731
- 16S-Sequencing analysis
- Whole genome SNP analysis

Results and significance

Measurements were carried out over a two-year period in the water supply systems of Lugano and Zurich to determine whether municipal water supply networks provide habitats and distribution pathways for clinically relevant *Legionella* spp.

Legionella spp. were detected in both distribution networks by means of PCR in Zurich with an average of $7.5 \cdot 10^5$ in a range from $2.1 \cdot 10^4$ to a maximum of $3.3 \cdot 10^6$ and in Lugano with an average of $1.6 \cdot 10^7$ in a range from $5.6 \cdot 10^3$ to $4.8 \cdot 10^8$ copies per litre.

Hydrants and their supply lines appear to be potential reservoirs for *Legionella* spp., especially at higher temperatures in summer.

L. pneumophila was detected in hydrants in Lugano, but only in one case in Zurich, possibly due to higher water temperatures and potentially higher nutrient levels in Lugano.

The incidence of legionellosis is significantly higher in Lugano than in Zurich. The reasons are unclear. It is an open question whether this is related to the *L. pneumophila* detected in the water distribution network of Lugano.

The optimised amoeba plate test can be used as a supplementary method for detecting *Legionella* spp. and determining their virulence. Using the APT, an *L. pneumophila* isolate was successfully isolated from a water hydrant in Lugano.

The study found that 21 of 94 Lugano hydrants tested positive for *L. pneumophila* and *L. pneumophila* serogroup 1 by PCR.

L. pneumophila isolates from the Lugano distribution network were genetically identical to clinical isolates from the region, indicating their clinical relevance.

Iron corrosion in hydrants can contribute to the growth of *Legionella* spp. and possibly increase their virulence. This should be clarified in further studies.

The study suggests that the current microbiological control parameters may not provide adequate protection against environmental pathogens, which underlines the need for new monitoring methods. 16S sequence analysis and the amoeba plate test could be evaluated as screening methods.

The Swiss population enjoys good drinking water quality, and water suppliers generally refrain from chlorinating tap water. Global warming will lead to higher tap water temperatures in the future. Therefore, growth of bacteria including environmental pathogens such as *Legionella* in the tap water network will likely be enhanced. Further risk assessment studies should be carried out to assess whether specific surveillance and treatment measures will need to be taken. Regular flushing of hydrants in problem areas of the affected water supply systems could possibly bring about a significant improvement.

Publications, posters and presentations

Moreno, A. B., Chen, T., Gökuguz, Y., Wälty, S., Schmid, C., Egli, A., Gaia V., Füchslin H.P., Hilbi, H. (2024). Optimization of the Amoeba Plate Test for the Isolation of *Legionella* and Other Opportunistic Pathogens from Environmental Water Samples. *ACS ES&T Water*, <https://doi.org/10.1021/acsestwater.4c00915>.

F., Füchslin, F. Di Rosario, Y. Goekuguz, S. Kaufmann und T. Egli (2024). Umweltpathogene im Verteilnetz. *Aqua & Gas*, (12).

In addition, the project was presented as a talk at the *Legionella* DACH conference, organized by the Robert Koch Institute in Wernigerode, Germany, on November 13th and 14th.

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