

RELEVANCE OF IRON CONTENT FOR *ESCHERICHIA COLI* GROWTH IN DRINKING WATER

Andrea F. Afonso^{1,2}, Bruno Pires², Cátia Gonçalves¹, Cristina Teixeira^{1,3}, António Nogueira^{1,4*}

ULSNE
UNIDADE LOCAL DE SAÚDE DO NORDESTE DE

ipb INSTITUTO POLITÉCNICO DE BRAGANÇA
Centro de Investigação de Montanha

¹Escola Superior de Saúde, Instituto Politécnico de Bragança (IPB), Avenida D. Afonso V, 5300-121 Bragança, Portugal;

²Laboratório de Saúde Pública de Bragança, Unidade Local de Saúde do Nordeste (ULSNE), Rua Eng. Adelino Amaro da Costa, 5300-146 Bragança, Portugal;

³Unidade de Investigação em Epidemiologia (EPIUnit), Instituto de Saúde Pública da Universidade do Porto, Rua das Taipas, n° 135, 4050-600 Porto, Portugal;

⁴Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança (IPB), Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *ajmnoqueira@ipb.pt

Background

The chemical and microbiological quality of drinking-water has been a public health concern. The chemical contaminants of drinking-water may have different sources, such as agricultural activities and damage of the distribution systems (e.g. compounds of the nitrogen cycle and heavy metals) [1]. In public water system of drinking water, different species of bacteria can promote the oxidation of ferrous iron [Fe(II)] coupled to nitrate (NO₃⁻) reduction, often referred to as nitrate-dependent iron oxidation [2]. In particular, *Escherichia coli* growth, an indicator of faecal contamination, could be related to the presence of iron (Fe) [3].

Aim

This research evaluated the relation between the iron (µg/L) and nitrate (mg/L) concentrations and the *E. coli* colony-forming units (CFUs) persistence in drinking water distribution systems.

Methods

Samples of drinking water (n=464) were analyzed according to the standard methods [4]:

➤ **Iron and nitrates:** spectrometry of molecular absorption

➤ ***E. coli* CFUs:** filtration by membrane method

Statistical approach:

➤ The proportion of samples with high number of *E. coli* CFUs (>80) were estimated and compared (qui-square test) according to the concentration of iron (<50 or >=50 µg/L) and nitrates (<1 or >=1 mg/L)

➤ Spearman's correlation coefficients (r_s) between iron or nitrate concentration and the number of *E. coli* CFU was estimated among only positive samples for *E. coli* (n=22)

➤ Significance level=0.05

Results

Table 1 – Evaluation of iron / nitrate levels and *E. coli* CFUs

	Iron concentration (µg/L)		Nitrate concentration (mg/L)	
	n (%)		n (%)	
	<50	>=50	<1	>=1
	n=343	n=121	n=155	n=309
0	326 (95.0)	116 (95.9)	151 (97.4)	291 (94.2)
1-80	11 (3.2)	0 (0.0)	4 (2.6)	7 (2.3)
>80	6 (1.7)	5 (4.1)	0 (0.0)	11 (3.6)
p-value	0.049		0.059	

- Higher proportion of >80 *E. coli* CFUs among samples with high iron concentration (p=0.049); no significant differences with nitrate concentration (p=0.059)

Conclusion

Overall, the results highlighted the correlation of iron concentration and the *E. coli* persistence in drinking water, while no significant differences were observed with nitrate concentration. In accordance with the legal requirements, the results are still far from what is desired, although periodic analyses are an indispensable aid to maintain the safety of drinking water.

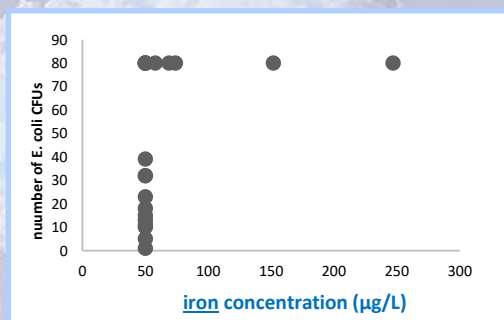


Figure 1 – Correlation between iron concentration and *E. coli* CFUs; r_s=0.497 (p=0.019)

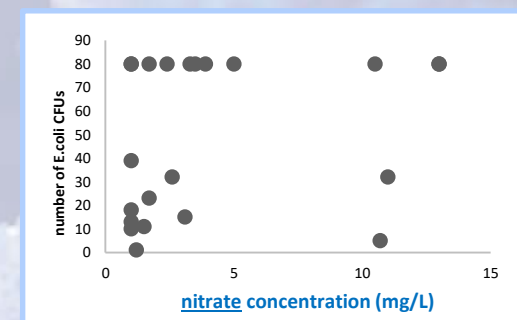


Figure 2 – Correlation between nitrate concentration and *E. coli* CFUs; r_s=0.335 (p=0.126)

Positive samples for *E. coli* (n=22)

- Significant correlation between **iron** concentration and *E. coli* CFUs; r_s=0.497 (p=0.019) (Figure 1)
- No correlation between **nitrate** concentration and *E. coli* CFUs; r_s=0.335 (p=0.126) (Figure 2)

References

- [1] World Health Organization, in Developing Drinking-Water Quality Regulations and Standards, World Health Organization, Geneva, 2018.
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