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# Microbiological Characterization of Thermal Waters

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## INTRODUCTION:

Thermal waters are used for disease prevention or treatment, for rehabilitation or welfare. The health risks associated with the use of these waters depends not only on the nature of the waters, but also on the manner of its use and the immune status of users. Exposure to microorganism scan occur through inhalation, ingestion or contact. The related severity and diversity of diseases leads to the verification of bacteriological standards established by law in order to ensure its quality and safety.

## OBJECTIVES:

To characterize microbiologically thermal waters of the northern region of Portugal.

## MATERIALS AND METHODS:

We conducted a study on water microbiological analysis results of northern Portugal, obtained between January 3, 2013 and December 12, 2013. The microbiological parameters studied to characterize the thermal waters included total microorganisms count at 37°C , 24 hours; microorganisms count at 22 °C, 72 hours; and *Escherichiacoli* and other coliforms, *Enterococcus* spp, sulphite-reducing anaerobes spores, *Pseudomonasaeruginosa* and *Legionella* spp detection. These parameters were analyzed according to sampling location (Vichy shower, water jet, bath tub, water captation, and water filter) and time (December to April and May to November). We classified the results according to microbiological standards established by Portuguese law (Ministerial Order no. 1220/2000 of December 29).

## RESULTS AND DISCUSSION:

We studied 158 water samples' records. Results are presented in Tables 1 and 2. Of all records, 54,1% of samples were in compliance regarding microorganisms count at 37°C, and 91,08% regarding microorganisms at 22°C. All samples were considered satisfactory for *E. coli*, total coliforms and sulphite-reducing anaerobes spores counts, regardless the sampling location. *Enterococcus* spp counts were in compliance with standard values in 99,4% of total samples, while 98,7% presented satisfactory *Pseudomonasaeruginosa* count. Satisfactory samples' frequency seems to be evenly distributed along the year (table 2).

**Table 1** - Absolute and relative frequency of samples (n (%)) in compliance with microbiological standards, according to sampling location.

Microbiological parameter	Standard values	Sampling location					TOTAL
		Vichy shower (n=27)	Water jet (n=27)	Bath tub (n=27)	Water filter (n=50)	water captation (n=27)	
Microorganisms at 37 °C (n=158)	≤5CFU/ml	16 (59,3)	9 (33,3)	16 (59,3)	17 (34,0)	27 (100,0)	85 (53,8)
Microorganisms at 22 °C (n=158)	≤20 CFU/ml	26 (96,3)	18 (66,7)	27 (100,0)	46 (92,0)	27 (100,0)	144 (91,1)
Coliforms (n=158)	≤ 0/ 250 ml	27 (100,0)	27 (100,0)	27 (100,0)	50 (100,0)	27 (100,0)	158 (100,0)
<i>Escherichia coli</i> (n=158)	≤ 0/ 250 ml	27 (100,0)	27 (100,0)	27 (100,0)	50 (100,0)	27 (100,0)	158 (100,0)
<i>Enterococosspp</i> (n=158)	≤ 0/ 250 ml	27 (100,0)	27 (100,0)	26 (96,3)	50 (100,0)	27 (100,0)	157 (99,4)
<i>Pseudomonas aeruginosa</i> (n=158)	≤ 0/ 250 ml	27 (100,0)	27 (100,0)	26 (96,3)	49 (98,0)	27 (100,0)	156 (98,7)
sulphite-reducing anaerobes spores (n=158)	≤ 0/ 50 ml	27 (100,0)	27 (100,0)	27 (100,0)	50 (100,0)	27 (100,0)	158 (100,0)
Legionella spp (n=7)	≤ 0/ 1000 ml	0 (0,00)	0 (0,00)	0 (0,00)	7 (100,00)	0 (0,00)	7 (100,00)
<b>TOTAL N (%)</b>		16 (59,26)	9 (33,33)	16 (59,26)	17 (34,00)	27(100,00)	85 (53,80)

**Table 2** - Absolute and relative frequency of samples (n, (%)) in compliance with microbiological standards, according to sampling time.

Microbiological parameter	Sampling location and time									
	Vichy shower (n=27)		Water jet (n=27)		Bath tub (n=27)		Water filter (n=50)		Water pump (n=27)	
	Dec - Apr	May- Nov	Dec - Apr	May- Nov	Dec - Apr	May- Nov	Dec - Apr	May- Nov	Dec - Apr	May- Nov
Microorganisms at 37 °C	9 (75,0)	7 (46,7)	3 (25,0)	6 (40,0)	6 (50,0)	10 (66,7)	10 (50,0)	7 (23,3)	12 (100,0)	15 (100,0)
Microorganisms at 22 °C (n=158)	12 (100,0)	13 (86,7)	7 (58,3)	11 (73,3)	12 (100,0)	15 (100,0)	18 (90,0)	28 (93,3)	12 (100,0)	15 (100,0)
Coliforms	12 (100,0)	15 (100,0)	12 (100,0)	15 (100,0)	12 (100,0)	15 (100,0)	20 (100,0)	30 (100,0)	12 (100,0)	15 (100,0)
<i>Escherichia coli</i>	12 (100,0)	15 (100,0)	12 (100,0)	15 (100,0)	12 (100,0)	15 (100,0)	20 (100,0)	30 (100,0)	12 (100,0)	15 (100,0)
<i>Enterococosspp</i>	12 (100,0)	15 (100,0)	12 (100,0)	15 (100,0)	11 (91,7)	15 (100,0)	20 (100,0)	30 (100,0)	12 (100,0)	15 (100,0)
<i>Pseudomonas aeruginosa</i>	12 (100,0)	15 (100,0)	12 (100,0)	15 (100,0)	11 (91,7)	15 (100,0)	19 (95,0)	30 (100,0)	12 (100,0)	15 (100,0)
Sulphite-reducing anaerobes spores	12 (100,0)	15 (100,0)	12 (100,0)	15 (100,0)	12 (100,0)	15 (100,0)	20 (100,0)	30 (100,0)	12 (100,0)	15 (100,0)
Legionella spp			0 (0,0)	0 (0,0)			3 (100,0)	4 (100,0)		

## CONCLUSION:

Despite of the reduced number of non-conform results, this study provides indicators for the development of improvement and corrective measures, to ensure microbiological quality and safety of the use of thermal waters.

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