Chemical parameters and occurrence of *Cryptosporidium* spp., in raw and treated water from Nariño, Colombia

P-WED-5

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Introduction

Water-borne transmission of *Cryptosporidium* has been highly reported around the world (1). *Cryptosporidium* infective oocysts have demonstrated remarkable resistance. Oocyst can interact with suspended and dissolved particles from water contamination, decreasing disinfection process efficacy (2,3). Detection from water and genotyping methods of *Cryptosporidium* are not enough, suggesting a research challenge in detection of potential human circulating pathogens strains.

Objective

To analyse the influence of chemical parameters and presence of *Cryptosporidium* in raw and drinking waters collected from three sampling sites in Nariño province, Colombia.

Methods

36 water samples from Pasto, Ipiales and Túquerres, were collected throughout September 2016.

We used an experimental plan covering:

- Effect of water time collection in both mornings and afternoon at either, week and weekend days,
- Type of samples from raw (R), post-treatment (PFQ) and post-disinfection (chlorination) (PCL). Figure 1.

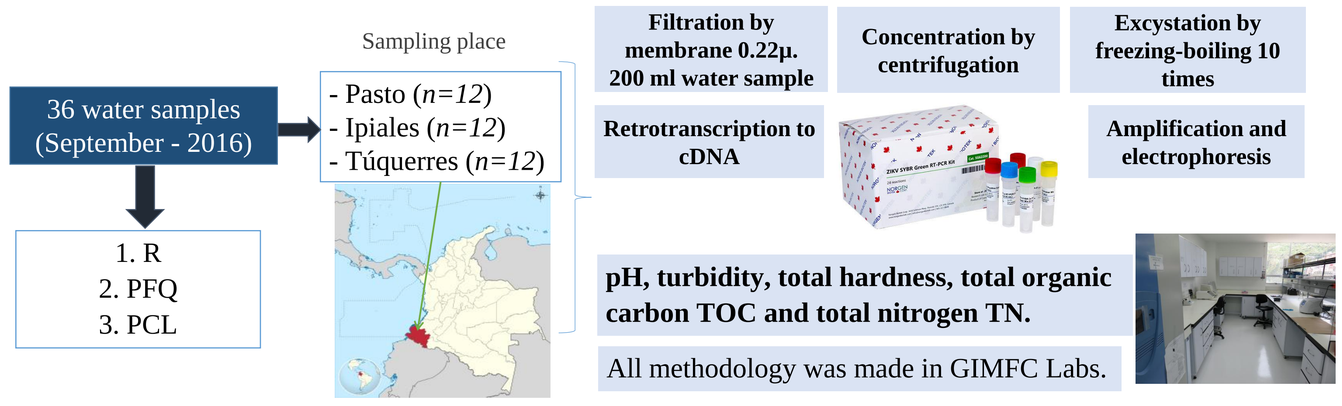

Figure 1. Workflow to analyze of chemical parameters and presence of *Cryptosporidium* in raw and drinking water collected from three sampling sites in department of Nariño, Colombia**.**

Results

- By the first time, the presence of *Cryptosporidium* in raw and treated waters from Nariño, Colombia was confirmed. Detection increased during weekend days.
- *Cryptosporidium* in water samples of raw, post-treatment and post-disinfection spots were detected through RT-PCR (Figure 2 and Table 1).

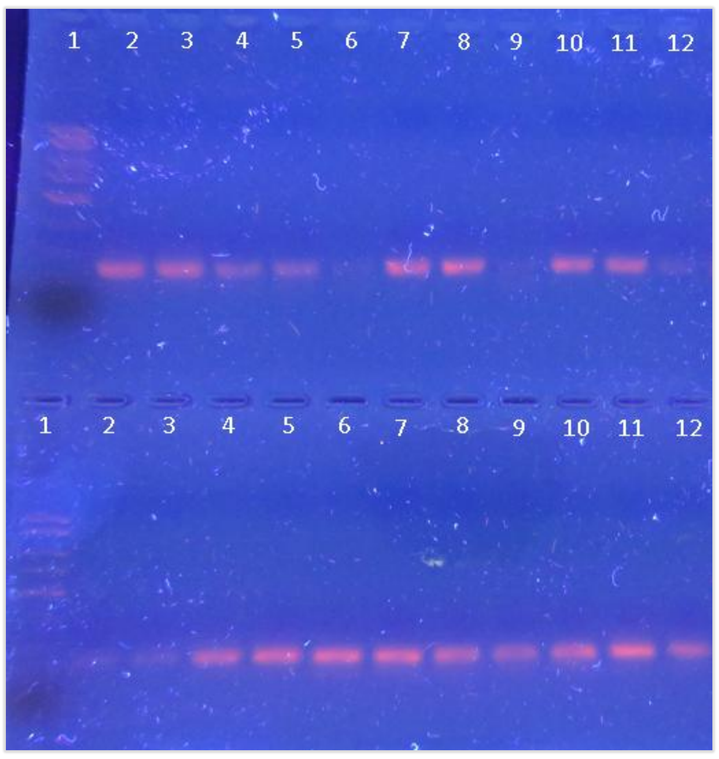

Figure 2. RT-PCR products for the detection of *Cryptosporidium* (218 bp) in 9 samples of water collected in the Department of Nariño.

Allowed limits for these parameters (2):

pH: range 6.5 to 9.0 **TOC**: 2 mg C/L
Total hardness: 300 mg CaCo3/L **Turbidity**: 2.0 UNT

Table 1. Representation of the electrophoresis results of the amplification products of the *Cryptosporidium* white gene (218 bp) in 9 water samples analyzed in test 3.

	WELL	1	2	3	4	5	6	7	8	9	10	11	12
DETECTION	SAMPLE	WM	C+	C-	PAS006	PAS011	TUQ010	TUQ011	IPI003	IPI008	IPI013	IPI021	IPI023
	CRYPTO TARGET		X	X	X	X		X	X		X	X	
CONTROL	WELL	1	2	3	4	5	6	7	8	9	10	11	12
	SAMPLE	WM	C+	C-	PAS006	PAS011	TUQ010	TUQ011	IPI003	IPI008	IPI013	IPI021	IPI023
	ISOLATION CONTROL		X										
	PCR CONTROL		X	X	X	X	X	X	X	X	X	X	X

WM = Weight marker; C+ = Positive control; C- = Negative control; PAS=Pasto; TUQ= Túquerres; IPI= Ipiales

- In raw water, turbidity and TOC high values from Pasto (6.7 mg C/L) and Ipiales (2,3 mg C/L) were found.
- A basic pH in three sampling sites was predominant. Total hardness was higher in raw and post-chemical treatment (Table 2).

Table 2. Results of physicochemical parameters in raw and drinking waters collected from three sampling sites in Nariño province, Colombia.

SAMPLES	TYPE OF WATER treatment	pH			TURBIDITY (UNT)			TOTAL HARDNESS (mgCaCO3/L)			TOTAL ORGANIC CARBON (COT) (mg C/L)			TOTAL NITROGEN (NT) (mg N/L)		
		Mean	TD	CV	Mean	TD	CV	Mean	TD	CV	Mean	TD	CV	Mean	TD	CV
PASTO	R	8.70	0.21	0.02	1.35	0.39	0.29	24.75	1.50	0.06	**6.7395**	0.88	0.13	**0.6594**	0.05	0.08
	PFQ	7.45	0.19	0.03	0.45	0.13	0.29	26.25	2.75	0.10	**3.5608**	0.77	0.22	**0.5045**	0.12	0.23
	PCL	7.35	0.22	0.03	0.58	0.10	0.17	23.5	2.08	0.09	**3.6110**	0.53	0.15	**0.4348**	0.02	0.05
TUQUERRES	R	7.58	0.22	0.03	1.98	0.52	0.26	96	10.06	0.10	0.4061	0.10	0.24	0.3170	0.02	0.07
	PFQ	7.66	0.11	0.01	1.38	0.32	0.23	91.875	14.71	0.16	0.5776	0.54	0.93	0.3141	0.02	0.07
	PCL	7.52	0.07	0.01	1.36	0.20	0.14	93.3	17.08	0.18	0.6736	0.34	0.50	0.3125	0.03	0.11
IPIALES	R	7.47	0.05	0.01	**2.18**	0.40	0.19	153	7.16	0.05	**2.2599**	2.69	1.19	1.0941	0.19	0.17
	PFQ	7.28	0.12	0.02	0.80	0.41	0.51	154.75	13.05	0.08	**2.0963**	0.42	0.20	0.9908	0.10	0.10
	PCL	7.11	0.08	0.01	1.55	1.26	0.81	144.25	13.28	0.09	**2.3363**	0.44	0.19	1.0021	0.11	0.11

TD = Typical deviation; CV = Coefficient of variation; R = raw water; PFQ = Post-treatment; PCL = Post-disinfection (chlorination)

Discussion

- **By the first time**, ***Cryptosporidium*** **in raw and treated water from Nariño, Colombia was confirmed**. Beside differences of MON in sources of water supply and between WTP, before and Pos chlorination the parasite was present.
- High turbidity, TOC and total hardness represent high and variable contamination of water sources and it was associated with high presence of parasite.
- It is necessary to continue with *Cryptosporidium*'s sequencing to identify circulating strains, and include more samples for improve our conclusions.

Conclusions

- **This is the first report of** *Cryptosporidium* from water in Nariño, Colombia.
- The parasite can resist to water treatment. **Is need sequencing, and confirm circulating strains and their potential pathogenic power**.
- The high water chemical parameters can explain the physical oocyst protection and the observed resistance to disinfection.

Acknowledgment

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