Prevalence and risk factors for *Strongyloides stercoralis* infection among patients at high risk of complications in Bolivia

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Introduction

Strongyloidiasis can be fatal in immunocompromised patients. The prevalence of this neglected tropical disease has never been evaluated in Bolivia using adequately sensitive tests. The aim of the study was to estimate the prevalence and risk factors for strongyloidiasis among patients at high risk of complications.

Methods

We conducted a multicenter study in Santa Cruz (400m altitude, tropical climate) and Cochabamba (2550m altitude, temperate climate) among patients with cancer, HIV, rheumatic or hematologic disease.

Strongyloides IgG antibody titers were measured by enzyme-linked immunosorbent assay (Bordier Affinity Products) and two fresh stool samples were analyzed using four parasitological techniques (direct smear, Ritchie, Baermann and agar plate culture).

A structured socio-demographic characteristics questionnaire was administered. Categorical variables were compared by chi-square test and $p<0.05$ was considered statistically significant. Multivariable logistic regression model was used to evaluate adjusted OR for positive stool test and serology.

Results

1151 patients participated. Serological and copro-parasitological prevalences were 23% (265/1151) and 7.6% (88/1151), respectively.

In both unadjusted and adjusted analyses, factors associated with positive coproparasitology ($p< 0.05$) were younger age, low education level, walking barefoot, OH consumption and low CD4 level. Younger age and low education level were associated with positive serology in univariate and multivariate analysis (tables 1&2).

There was no difference in prevalence between Cochabamba and Santa Cruz as defined by coproparasitology (6.4% versus 8.9%; p=0.11) or serology (24% versus 22%; p=0.40). Among 64 patients in Cochabamba who had never traveled to the tropical lowlands, 5 (7.8%) had a positive coproparasitology.

Table 1: Univariate analysis of potential risk factors of *S. stercoralis* infection diagnosed by coproparasitology or serology, Bolivia, 2012-13.

		Coproparasitology positive		Serology positive	
	n	n (%)	p	n (%)	p
REGION					
Cochabamba	573	51 (8.9%)	0.11	126 (22%)	0.40
Santa Cruz	578	37 (6.4%)		139 (24%)	
Age					
<40 years old	384	42 (10.9%)		99 (25.8%)	
≥40-<60 years old	540	39 (7.2%)	**0.002**	127 (23.5%)	**0.047**
≥60 years old	227	7 (3.1%)		39 (17.2%)	
Gender					
Men	377	40 (10.6%)	**0.008**	89 (23.6%)	0.74
Women	774	48 (6.2%)		176 (22.7%)	
Education level					
Primary school	400	55 (13.8%)		126 (31.5%)	
Secondary school	517	29 (5.6%)	**<0.001**	105 (20.3%)	**<0.001**
University	234	4 (1.7%)		34 (14.5%)	
Living area					
Rural	172	22 (12.8%)	**0.006**	48 (27.9%)	0.097
Urban	976	66 (6.8%)		216 (22.1%)	
Walking without shoes					
Sometimes/frequently	781	68 (8.7%) 15	**0.034**	195 (25.0%)	**0.046**
Never	306	(4.9%)		59 (19.3%)	
Alcohol consumption					
Occasional-frequently	261	29 (11.1%)	**0.009**	63 (24.1%)	0.63
Never	889	56 (6.3%)		202 (22.7%)	
Corticoids in last 3 months					
Yes	243	10 (4.1%)	**0.02**	52 (21.4)	0.50
No	908	78 (8.6%)		213 (23.5%)	
CD4					
<300 CD4	171	31 (18.1%)	**<0.001**	43 (25.1%)	0.98
≥300CD4 or HIV not known	880	57 (6.5%)		222 (25.2%)	

Table 2: Multivariate analysis of potential risk factors of *S. stercoralis* infection diagnosed by coproparasitology or serology, Bolivia, 2012-13

	Stools positive		Serology positive	
	p	Adjusted OR	p	Adjusted OR
Cochabamba vs **Sta Cruz**	**0.01**	**2.0 (1.2-3.5)**	0.82	1.04 (0.741.45)
Age 10 years difference	**<0.0001**	**0.7 (0.6-0.8)**	**0.001**	0.8 (0.8-0.9)
Men vs **women**	0.11	1.5 (0.9-2.6)	0.42	1.1 (0.8-1.6)
Primary school	**<0.0001**	**13.2(4.5-38.8)**	**<0.0001**	**3.1 (1.9-4.9)**
Secondary school	**0.025**	**3.4 (1.2-10.2)**	**0.02**	**1.68 (1.1-2.6)**
University	1.0 (ref)	-	1.0 (ref)	-
Rural vs **urban**	0.11	1.6 (0.9-2.8)	0.25	1.2 (0.8-1.8)
Walking barefoot	**0.004**	**2.61 (1.3-5.1)**	0.12	1.34 (0.93-1.94)
OH consumption	**0.045**	**1.72 (1.0-2.9)**	0.99	1.00 (0.70-1.41)
Corticoids	0.72	1.1 (0.5-2.5)	0.27	1.25 (0.84-1.86)
<300 CD4	**0.01**	**2.1 (1.2-3.8)**	0.74	0.93 (0.60-1.43)

Conclusion

The study demonstrates that strongyloidiasis is widely present in two large Bolivian cities among vulnerable patients at risk of complications. Given the known diagnostic performance of the serological test, the actual prevalence of strongyloïdiasis is estimated at around 20%.

The transmission of this parasitosis is highest in tropical and subtropical areas, but also occurs at altitudes over 2500 meters, in regions with a temperate climate, as shown in Cochabamba.

Bolivia should reinforce control strategies to prevent complications from this serious parasitic disease.

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