Prevalence and Risk Factors for Intestinal Parasitic Infections in a Rural Community in "Consolación del Sur" Municipality, Cuba

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ABSTRACT

Intestinal parasites are very common infections worldwide and they are responsible for significant public health problems. The World Health Organization estimates that one-third of the world population is infected and some epidemiologic factors related to the transmission have been identified. The purpose of this investigation was to study the prevalence of intestinal parasitic infections in people living in the rural community of "El Canal", Consolación del Sur municipality and the association with some epidemiologic risk factors. All participants were subjected to three methods of parasitological examinations on the stool samples and by immunodiagnostic tests which allow the detection of excretory-secretory antigens of adults with Fasciola hepatica. *The global prevalence rate of intestinal parasitic infections (IPIs) was 18%, and 16.7% for protozoan infections, while the rate of helminth infection was lower (5.3%) in the population studied. The univariate analysis identified three factors associated with intestinal pathogenic protozoan infections which include livestock work, drinking water from well\river and eating unwashed fruits/vegetables. The multivariate logistic regression using introduction test ratified the association of these risk factors. Contrary to what have been published in the majority of Cuban studies carried out in rural places, a higher prevalence of protozoan than helminth infection was found. This discrepancy may be explained because the majority of the workers in this rural community were stock-breeders and they are not involved in other agricultural work. The identification of risk factors is important in order to design appropriate strategies for control of IPIs in communities.*

Keywords: Intestinal parasitic infections, risk factors, rural community, stool examinations

Prevalencia y factores de riesgo de las infecciones parasitarias intestinales en una comunidad rural en el municipio de "Consolación del Sur", Cuba

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RESUMEN

Los parásitos intestinales constituyen infecciones muy comunes en todo el mundo, y son la causa de serios problemas de salud pública. La Organización Mundial de la Salud estima que un tercio de la población mundial está infectada con estos parásitos, y se han identificado algunos factores epidemiológicos relacionados con su transmisión. El propósito de esta investigación fue estudiar la prevalencia de las enfermedades parasitarias intestinales en personas que viven en la comunidad rural de "El Canal", municipio de Consolación del Sur, y la asociación con algunos factores de riesgo epidemiológicos. Todos los participantes fueron sometidos a tres métodos de exámenes parasitológicos en las muestras de heces, y a pruebas inmunodiagnósticas que permiten la detección de antígenos excretores-secretores de adultos con duela del hígado (Fasciola hepatica). La tasa de prevalencia global de las infecciones parasitarias intestinales (IPI) fue 18%, y 16.7% para las infecciones por protozoarios, mientras que la tasa de infección por helmintos fue menor (5.3%) en la población

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estudiada. El análisis univariante identificó tres factores asociados con infecciones intestinales por protozoos patógenos, que incluyeron el trabajar con ganado, beber agua de pozos o ríos, y comer frutas y vegetables sin lavar. El análisis multivariante mediante regresión logística con pruebas de introducción ratificó la asociación de estos factores de riesgo. Contrario a lo que ha sido publicado en la mayoría de los estudios cubanos realizados en áreas rurales, se halló una mayor prevalencia de infecciones por protozoos que de infecciones helmínticas. Esta discrepancia puede tener como explicación el que la mayoría de los trabajadores en esta comunidad rural eran ganaderos, y no estaban involucrados en otros trabajos agrícolas. La identificación de factores de riesgo es importante a la hora de diseñar estrategias adecuadas para el control de las IPIs en las comunidades.

Palabras claves: Infecciones parasitarias intestinales, factores de riesgo, comunidad rural, examen de heces

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INTRODUCTION

Intestinal parasitic infections (IPIs) are globally endemic and they have been described as important health and social problems in many countries (1). The soil-transmitted helminths (STHs) and protozoan infections may lead to malabsorption, abdominal pain, blood loss, diarrhoea, impaired work capacity and retarded growth, mainly in children (2).

Approximately half of the world's populations, particularly those who reside in tropical areas, are infected with intestinal parasites (3). Since the 1960s, the prevalence of IPIs in Cuba has decreased as a consequence of the implementation of various health programmes and improvement in sanitation and the supply of drinking water (4). However, despite public health campaigns and increased access to medical services, these infections are still affecting some rural and mountainous areas of the country (5). Some epidemiologic factors related to acquisition of intestinal parasitism, such as the absence of sanitary toilet facilities, eating unwashed/raw vegetables and drinking water from well or rivers have been identified (5, 6).

A few studies on IPIs in Pinar del Río province have been published but the majority of them have been focussed on preschool or school children (5–8). However, there is lack of investigations concerning IPIs in the general populations from rural areas in Cuba. The objectives of this investigation were to study the prevalence of intestinal parasitic infections in people living in the rural community of "El Canal", Consolación del Sur municipality, and their association with some epidemiologic risk factors.

SUBJECTS AND METHOD

A cross-sectional survey was carried out from February 2011 to February 2012, in the rural community "El Canal" located in the north of Consolación del Sur municipality (83.3783° O and 22.5535° N), Pinar del Río province, Cuba. There are two medical dispensaries and 1200 inhabitants. The main source of employment in the community is cattle rearing which is developed in surrounding areas of the town where 1528 heads of cattle are bred.

In a previous survey carried out in La Palma (9), a bordered municipality from the same province, the prevalence reported was 34%. Using a prevalence of infections of 34%, a total sample size of 288 out of 1200 total inhabitants was calculated for 90% confidence level. Assuming that up to 5% of those persons would be unavailable or unwilling to participate; a total of 300 individuals were sampled. This represented about one fourth of the population.

The community consisted of 13 buildings (central position) and four clusters of 26 individual houses (peripheral position), and we randomly selected 200 persons from buildings and 100 from clusters of houses (Figure).

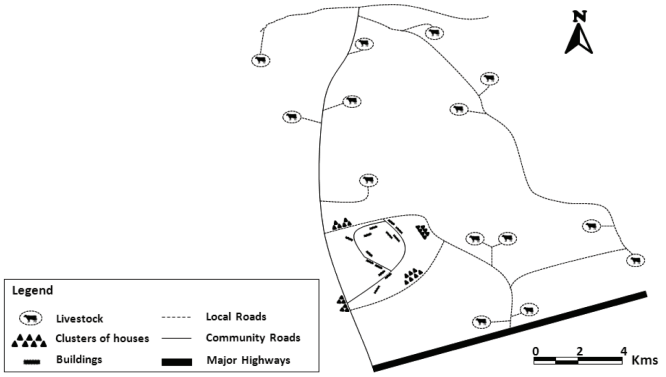

Figure: Map of the "El Canal" community, Consolación del Sur municipality, Pinar del Río province, Cuba.

Stool samples collection and parasitological techniques

The day before the survey, two flasks together with an information sheet explaining the procedure of sample collection were distributed for each individual. The stool samples were collected immediately and were macroscopically examined, placed in an ice box and sent to the intestinal parasitic infections laboratory at the Institute of Tropical Medicine "Pedro Kourí" (IPK). The samples from the first set of flasks were kept at 4 °C until examination by direct wet mount, brine's flotation (Willis) and Kato-Katz thick smear techniques. The samples from the other set of flasks were kept at -20 °C to perform FasciDIG® immunodiagnostic test which allow the detention of excretory-secretory antigens (ESAg) of *Fasciola hepatica* adults (10).

Collection of data and ethical considerations

A questionnaire was given to each subject in order to obtain information about the sociodemographic and epidemiological data (*ie* gender, age groups, occupation). The study protocol was approved by the Ethics Committee of the IPK and the local health authorities of Consolación del Sur municipality before the start of the study. Written informed consent was obtained from each participant in the study or from parents or guardians in case of minors.

Statistical analyses

The Epi-Info 6.04 (Centers for Disease Control and Prevention; Atlanta, GA, USA) and Statistical Package for the Social Sciences (SPSS Inc, PASW Statistics 18, Chicago, USA) statistical programmes were used for the selection of the sampled population and the analyses of data derived from questionnaires and parasitological examinations, respectively. Chi-square and proportion tests were used to assess the significance of the observed associations. The Fisher's exact test was used when required by data scarcity. Univariate analyses used all available input variables. A multivariate logistic regression using introduction test was used to determine whether each independent variable was significantly related to the outcome variable. The odds ratio (OR) with 95% confidence intervals (CI) were used to approximate the relative risk associated with exposure. The differences were considered to be statistically significant when the *p*-value obtained was less than 0.05.

RESULTS

The collected samples from 300 individuals (150 males and 150 females) were examined by parasitological techniques (response rate was 100%). The age range of participants was between one and 75 years old. The prevalence of IPIs in general was 18% (54/300). The overall prevalence of intestinal helminth infections was 5.3%, corresponding to higher prevalence of 2%, 1.67%, 0.67% and 0.67% for hookworm, *Enterobius vermicularis, Trichuris trichiura* and *Strongyloides stercoralis* infections, respectively (Table 1). The prevalence of protozoan infection was 16.7%. Among them, *Entamoeba histolytica/E dispar* complex showed a 2.3% of prevalence, followed by *Giardia intestinalis* (1.3%). The non-pathogenic protozoa including *Endolimax nana* (7.67%) and the species of pathogenic *Blastocystis* spp (5%) were the most prevalent among all protozoa and helminth species.

Table 1: Prevalence of intestinal parasitic infections in "El Canal" community

Parasite species	Prevalence	
	n (%)	95% CI
Protozoa		
Entamoeba histolytica/E dispar	7 (2.33)	0.46, 4.21
Giardia intestinalis	4 (1.33)	0.36, 3.38
Endolimax nana **	23 (7.67)	4.49, 10.84
Blastocystis spp *	15 (5.00)	2.37, 7.63
Entamoeba coli **	11 (3.67)	1.37, 5.96
Chilomastix mesnili **	1 (0.33)	0.01, 1.84
Iodamoeba buetschlii **	1 (0.33)	0.01, 1.84
Entamoeba hartmanni **	1 (0.33)	0.01, 1.84
Helminths		
hookworms	6 (2.00)	0.25, 3.75
Enterobius vermicularis	5 (1.67)	0.54, 3.85
Trichuris trichiura	2 (0.67)	0.08, 2.39
Strongyloides stercoralis	2 (0.67)	0.08, 2.39
Ascaris lumbricoides	1 (0.33)	0.01, 1.84
Fasciola hepatica	1 (0.33)	0.01, 1.84

(n = 300) *pathogenic discussed ** non-pathogenic protozoa

In the univariate analysis performed, water supply from well or river (OR = 4.36, 95% CI: 1.57, 12.14) was identified as a factor associated with intestinal helminth infections. Multivariate analysis using introduction test logistic regression confirmed the water supply from well or river (OR = 5.29, 95% CI: 1.72, 16.25) as a significant risk factor for intestinal helminth infections (Table 2).

The univariate analysis identified three factors associated with intestinal pathogenic protozoan infections (Table 3) which include livestock work (OR = 6.15, 95% CI: 3.22, 11.74), water from well or river (OR = 2.41, 95% CI: 1.24, 4.71) and eating fruits and vegetables without washing (OR = 2.75, 95% CI: 1.33, 5.66). Multivariate analysis using introduction test logistic regression ratified the association of the following factors: livestock work (OR = 8.13, 95% CI: 3.6, 18.34), water from well or river (OR = 2.7, 95% CI: 1.24, 5.85) and eating fruits and vegetables without washing (OR = 2.34, 95% CI: 1.0, 5.42) with protozoan infections.

Table 2: Potential risk factors associated with helminth infections

Characteristics	Total n = 300	Helminth infection	Univariate		Multivariate	
		n (%)	OR (95% CI)	*p-value*	OR (95% CI)	*p-value*
Gender						
Female	150	5 (3.3)	2.3 (0.78, 6.77)	0.133	2.75 (0.85, 8.97)	0.093
Male	150	11 (7.3)				
Age groups (years)						
1 – 14	38	1 (2.6)	2.25 (0.29, 17.52)	0.440	2.01 (0.219, 18.5)	0.537
≥ 15	262	15 (5.7)				
Primary school assistance						
Yes	29	1 (3.4)	1.64 (0.21, 12.89)	0.638	2.06 (0.23, 18.24)	0.516
No	271	15 (5.5)				
Occupation						
Livestock work	79	6 (7.7)	1.73 (0.61, 4.94)	0.302	2.07 (0.6, 7.17)	0.250
Non-livestock work	221	10 (4.5)				
Sanitary conditions						
Water supply						
Water from well or river	61	8 (13.1)	4.36 (1.57, 12.14)	0.005	5.29 (1.72, 16.25)	0.004
Piped water	239	8 (3.6)				
Toilet use						
Latrine or open-air defecation	71	6 (8.5)	2.02 (0.71, 5.77)	0.189	1.8 (0.58, 5.63)	0.311
Toilet	229	10 (4.4)				
Personal hygienic habits						
Drinking boiled water practices						
Yes	16	0 (0)	–	0.999	–	0.998
No	284	16 (5.6)				
Eating fruits and vegetables without washing						
Yes	45	4 (8.9)	1.97 (0.61, 6.42)	0.258	2 (0.54, 7.33)	0.298
No	255	12 (4.7)				
Walking barefoot						
Yes	140	7 (5.0)	0.88 (0.32, 2.44)	0.81	0.92 (0.29, 2.97)	0.892
No	160	9 (5.6)				
Sucking fingers and/or nail biting						
Yes	51	3 (5.9)	1.14 (0.31, 4.14)	0.85	1.17 (0.29, 4.83)	0.824
No	249	13 (5.2)				

DISCUSSION

The IPIs are important worldwide contributors to health and socio-economic problems and more than a billion people are currently infected by at least one species of this group of pathogens (11, 12). In Cuba, despite significant reduction in the prevalence of IPIs at the national level (13), there are still high prevalent levels of soil transmitted helminth infections in rural or mountainous areas where they affect mainly school children (7, 8). In addition, in some day care centres, the prevalence of *Giardia intestinalis* is higher than other educational institutions, but this last observation may be more related with the age group than the type of institution (14–16).

In our investigation, the protozoa *Entamoeba histolytica*/*E dispar* and *Giardia intestinalis* were detected at similar rates of prevalence as those in a suburban area in Thailand (17) and in another national study performed in Cuba (13). We unexpectedly found a higher prevalence of protozoan than helminth infections. These findings do not agree with various previous studies for IPIs carried out in Cuban rural areas where the prevalence of soil transmitted infections was found to be higher (7, 8). The main mode in the study area was livestock, while in previous studies in rural areas of Cuba, the main activities were other agricultural activities where the people live in a closer contact with the soil and probably may have a higher risk for soil transmitted helminth infections (8).

Among helminths, hookworm infections (2%) were the most frequent; similar results were found in a study conducted in China (18). The second most frequent helminth was found to be *Enterobius vermicularis*. Additional diagnostic methods that specifically would detect this specie of helminth, such as Graham or anal swabs (13), could be used in future studies to improve the diagnosis, taking into account peculiarities of its life cycle. In this study, we observed that infections due to helminths were associated with water

Table 3: Potential risk factors associated with protozoan infections

Characteristics	Total n = 300	Protozoan infection	Univariate		Multivariate	
		n (%)	OR (95% CI)	*p-value*	OR (95% CI)	*p-value*
Gender						
Female	150	27 (18)	1.21 (0.66, 2.23)	0.536	1.05 (0.52, 2.13)	0.886
Male	150	23 (15.3)				
Age groups (years)						
1 – 14	38	6 (15.8)	1.08 (0.43, 2.73)	0.877	2.29 (0.75, 6.98)	0.145
≥ 15	262	44 (16.8)				
Primary school assistance						
Yes	29	6 (20.7)	1.35 (0.52, 3.5)	0.542	1.20 (0.40, 3.6)	0.740
No	271	44 (16.2)				
Occupation						
Livestock work	79	30 (38)	6.15 (3.22, 11.74)	0.000	8.13 (3.6, 18.34)	0.000
Non-livestock work	221	20 (9)				
Sanitary conditions						
Water supply						
Water from well or river	61	17 (27.9)	2.41 (1.24, 4.71)	0.010	2.7 (1.24, 5.85)	0.012
Piped water	239	33 (13.8)				
Toilet use						
Latrine or open-air defecation	71	13 (18.3)	1.16 (0.6, 2.34)	0.671	1.39 (0.61, 3.14)	0.430
Toilet	229	37 (16.2)				
Personal hygienic habits						
Drinking boiled water practices						
Yes	16	2 (12.5)	0.70 (0.16, 3.19)	0.647	1.88 (0.35, 10.22)	0.466
No	284	48 (16.9)				
Eating fruits and vegetables without washing						
Yes	45	14 (31.1)	2.75 (1.33, 5.66)	0.006	2.34 (1.0, 5.42)	0.048
No	255	36 (14.1)				
Walking barefoot						
Yes	140	28 (20)	1.57 (0.85, 2.89)	0.149	1.13 (0.53, 2.44)	0.747
No	160	22 (13.8)				
Sucking fingers and/or nail biting						
Yes	51	10 (19.6)	1.27 (0.59, 2.75)	0.537	1.24 (0.52, 2.96)	0.633
No	249	40 (16.1)				

supply. The persons who ingested water from wells or rivers were more infected, perhaps because the water from these sites were untreated and the persons who reside in houses without piped water supply live in more ruralized conditions with a more close contact with soil and a higher risk for helminth infections. Other studies have also reported the high association of this epidemiological risk factor with helminth infection (1, 19). The use of untreated water is considered a potential risk for acquiring helminth infections, not only by direct ingestion but also when used in watering the crops that are eaten unwashed or improperly washed (20). The protozoan infections were associated with different risk factors. There was a greater chance of infection by these pathogens in people who did not wash fruits and vegetables than those who did. It is known that one of the main routes of transmission of these species is through water contaminated with faeces (21, 22). In addition, we observed that the risk for protozoan infections is higher in people who obtain water from sources other than the official water supply systems. The supply of drinking water of potable quality and adequate excreta disposal are fundamental in reducing morbidity and mortality of infectious intestinal diseases. Some studies have identified different sources of water supply as a risk factor for infection from parasitic diseases (6, 23). These results agree with those reported by Sanjurjo *et al* (24), who found the highest percentage (58.3%) of protozoan infection in people who use water from wells. In another study concerning hospitalized children, it was found that those who drank water from wells or rivers had higher risk of IPIs than those who drank from government pipes (6).

It is known that water is an important medium of transmission for protozoan and other infectious diseases affecting thousands of people during waterborne outbreaks (11, 22). For that reason, it is necessary to take preventive measures to decrease transmission of these pathogens and waterborne outbreaks. Moreover, livestock workers had a higher risk of infection with protozoa compared to those who did other work. It is known that people living in rural areas

have increased risk of parasitic infections and one of the factors that may influence the acquisition of these infections is inadequate hygienic-sanitary conditions (25, 26). Despite the economic and cultural transformations (mainly free access to educational and healthcare facilities achieved in Cuba), there are still persistent epidemiological conditions that contribute to the problem of intestinal parasites in some areas (7, 8, 15, 27).

In the national survey for intestinal parasitic infections conducted in 1983, 54.6% of the population was found infected, of which 33% was infected with pathogenic parasites; the most affected age group was school children (24, 28). More recently, a national survey conducted by Rojas *et al* showed a decrease in the frequency of people infected by intestinal parasites [32.72%] (13). The low prevalence of parasitic intestinal infections in this community may be due to increased urbanization, hygienic education as well as the accessibility of people to health services with two medical clinics in this population. Another important factor might be the self-medication with anti-parasitic drugs, although these data were not collected in the study.

CONCLUSION

There was a higher prevalence of protozoan than helminth infection in the studied community. This discrepancy with findings from most studies could be attributed to the differences in the lifestyle and main mode of labour in the involved communities. In fact, the majority of the inhabitants are stock-breeders and they are not involved in other agricultural labour. In addition, many of them obtain water from wells or rivers. The identification of risk factors is important in order to design appropriate strategies for control of IPIs in every community.

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