Prevalence, Risk Factors and Clinical Features Associated with Intestinal Parasitic Infections in Children from San Juan y Martínez, Pinar del Río, Cuba

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ABSTRACT

A cross-sectional study was carried out in 200 children aged 5–15 years, to examine the presence of intestinal parasitic infections (IPIs) and to assess the risk factors and clinical features associated with them in children in San Juan y Martinez (SJM), Cuba. Three fresh faecal samples were collected from each child and were examined by direct wet mount, brine flotation, formalin-ether and Kato-Katz techniques. Data relating to demography, source of drinking water, personal hygiene habits and clinical features were also collected. Living in the rural area was significantly associated with the highest infection rates (p < 0.01). According to clinical features and laboratory examinations, children with abdominal pain were about four times more likely to have IPIs (OR 4.05, CI, 1.11, 13.18) especially soil-transmitted helminths (STH). We suggest that IPIs, especially STH, in SJM should be strongly suspected in children with abdominal pain from rural areas. Targeted and frequent interventions to control these infections are needed in this municipality.

Prevalencia, Factores de Riesgo, y Aspectos Clínicos Asociados con las Infecciones Parasitarias Intestinales en Niños de San Juan y Martínez, Pinar del Río, Cuba

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RESUMEN

Se llevó a cabo un estudio transversal en 200 niños de 5–15 años para examinar la presencia de infecciones parasitarias intestinales (IPI) y evaluar los factores de riesgo y los aspectos clínicos asociados con ellas, en niños de San Juan y Martinez (SJM), Cuba. Tres muestras fecales frescas de cada niño fueron recogidas y examinadas mediante preparación fresca directa, flotación en salmuera, éter-formalina y técnicas de Kato-Katz. También se recogieron datos en relación con la demografía, fuentes de abastecimiento de agua potable, hábitos de higiene personal y características clínicas. El vivir en el área rural estaba significativamente asociado con las más altas tasas de infección (p < *0.01). De acuerdo con las características clínicas y los exámenes de laboratorio, los niños con dolor abdominal tenían una probabilidad cuatro veces mayor de tener IPI (OR 4.05, CI, 1.11, 13.18) especialmente helmintos transmitidos por el suelo (HTS). Sugerimos sospechar fuertemente la presencia de IPIs, especialmente de HTS en SJM, en niños con dolor abdominal, provenientes de las áreas rurales. Se necesitan intervenciones frecuentes, dirigidas a controlar estas infecciones en esta municipalidad.*

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INTRODUCTION

Intestinal protozoa and soil-transmitted helminths (STH) still continue to be major problems in health worldwide, especially in the tropical and sub-tropical regions (1). Although frequent, these infections are not always trivial. They can be the cause of a wide clinical spectrum ranging from apparently symptomless infections to life-threatening conditions such as intestinal obstruction in *Ascaris* infection (1).

Clinical observations, unpublished reports and hospital records in Pinar del Río, a province of Cuba, have indicated that intestinal parasitic infections (IPIs) are widely prevalent among pre-school and school children. Unfortunately, there is a lack of community-based studies which provide information on the epidemiology of these infections in this municipality. These data could be useful in understanding the patterns of infections and planning effective strategies for IPIs control.

The goal of the present study was to determine some of the main risk factors and clinical features associated with IPI in presumed healthy children who attend educational centres in San Juan y Martínez (SJM), a municipality of Pinar del Río, Cuba.

SUBJECTS AND METHODS

Study Area – This study took place in SJM, a municipality of Pinar del Río, a province located in the western part of the Cuban archipelago. This municipality, which covers 409 km^2, has 47 181 inhabitants of whom 6617 (14.02%) are children from 1–15 years of age. The climate is mostly warm with a dry and a rainy season. SJM, as the rest of the country, has experienced economic and social changes during the past four decades. As a result, there has been a marked improvement in the life-style and in the health status of the inhabitants. The educational level of the population is to secondary school level or above and the majority of them work in tobacco plantations. Other crops in the area are vegetables, greens, rice and fruits. Healthcare is delivered by government primary healthcare polyclinics and family doctors dispensaries staffed by nurses and physicians.

Sampling frames and selection: We used randomized cluster samples based on classrooms (2). We aimed to achieve a sample of at least 180 children from 1 to 15 years. Using estimates of the design effect from previous surveys and given a prevalence of IPI of 55%, we calculated that these samples would give a precision (95% confidence interval [CI]) of 4%. The listing units were the classes which were randomly selected from each cluster with the aid of a random numbers table. As a result, 180 children were enrolled in the study and an additional 20 children were included for possible drop-outs. The children were selected randomly from all school-age children (defined as those between 6 and 15 years of age) and of all children enrolled in day-care centres.

Parasitological Examination: Three fresh faecal samples were collected from each child. They were examined by direct wet mount, brine flotation, formalin-ether and Kato-Katz techniques (3). Specimens positive for hookworm eggs were cultured according to Harada-Mori tube larval cultivation technique to verify whether the hookworm eggs excreted were eggs of *Necator americanus* or *Ancylostoma duodenale* (3).

Data Collection: A questionnaire was administered by the same observer (RC) to parents or legal guardians of each child and it covered the following selected areas (taking into account that these are the main characteristics commonly related to IPI): demographics, source of drinking water, personal hygienic habits of the children and clinical features. The latest were compared with the parasitological results in order to estimate the sensitivity, specificity and positive predictive value.

Statistical Analysis: All data derived from questionnaires and parasitological examinations were entered and analysed using EPI-INFO 6 statistical programme. Chi-square tests were used to assess the significance of the observed associations. The Fisher's exact test was used when required by data scarcity. The odds ratios (OR) with 95% confidence intervals (CI) were used to approximate the relative risk associated with exposure. A significant level of 0.05 was adopted for all tests.

Ethical considerations: The study protocol was approved by the Ethics Committee of the Institute "Pedro Kourí" and the local health authorities of SJM. Oral informed consent for participation was obtained from parents and legal guardians on behalf of their children, as the study posed no risk to participants. All those who harboured pathogenic IPI were referred to his/her general practitioner in order to be treated appropriately.

RESULTS

All selected 200 participants took part in the study (response rate 100%). Among the studied sociodemographic characteristics and personal hygienic habits, only the place of residence was significantly associated with the prevalence of IPIs (Table 1). The overall prevalence of intestinal helminth infections was 59.5% in San Juan y Martínez, corresponding to prevalences of 40.5%, 35.5% and 5.5% for *A lumbricoides*, *T trichuria* and hookworm infections, respectively. *Giardia lamblia* was the commonest pathogenic protozoan found with 38.5% prevalence, followed by the complex *Entamoeba histolytica*/*E dispar* (3%). The prevalences of IPI in general (156/166; 93.8%) and helminths were significantly higher in children living in rural areas than in those living in urban areas (26/34, 76.4%, $p = 0.0034$).

When clinical features, as well as age and gender, were tested as predictors for infections, only abdominal pain was associated with them (Table 1). Children with abdominal pain were about four times more likely to have IPI in their faecal specimens than children who had not (O.R, 4.05; CI, 1.11, 13.18). Its sensitivity, specificity and positive predictive value were 89%, 31.6% and 92.5%, respectively. The same symptom was also associated with an increased presence of STH (OR, 3.72; CI 1.03, 11.89). Sensitivity was 92.8%, specificity 20.2% and positive predictive value 59.2% (data not shown).

Table 2 shows the main helminthic and intestinal protozoan infections found and the relationship with age. The prevalence of *Ascaris* did not differ between age groups. However, the prevalence of *Trichuris* infection increased

Table 1: Significant relation for the intestinal protozoa and STH in the study population.

Characteristics	Group	Investigated children	Infected with Protozoa or Helminths No.	(%)	OR [CI	*p* value
Sociodemographic characteristics						*P* value
Gender	Female	121	110	(90.9)		*p* = 0.9556
	Male	79	72	(91.1)		
Age group	< 6 years	25	21	(84)		
	6-10 years	127	117	(92.1)		
	> 10 years	48	44	(91.7)		*p* = 0.4235
Residence	Rural	166	156	(93.8)		*p* = 0.0034 *
	Urban	34	26	(76.4)		
Water supply	Aqueduct	53	47	(88.6)		*p* = 0.6827
	Non-aqueduct	147	135	(91.8)		
Educational centre	DCC	10	9	(90)		*p* = 1.00
	Primary school	160	147	(91)		
	Secondary school	20	16	(80)		
	Special school	10	10	(100)		
Total	Investigated	200	182	(91)		
Personal hygienic habits					OR [CI	*p* value
Drinking untreated water	Yes	3	2	(66.6)	0.19 [0.01-11.79]	*p* = 0.2475 †
	No	197	180	(91.3)		
Sucking fingers and/or nail biting	Yes	103	94	(91.2)	1.07 [0.36-3.19]	*p* = 0.9094
	No	97	88	(90.7)		
Eating fruits without washing	Yes	114	105	(92.1)	1.36 [0.46-4.07]	*p* = 0.7044
	No	86	77	(89.5)		
Walking barefoot	Yes	160	146	(91.2)	1.16 [0.26-3.99]	*p* = 0.5034†
	No	40	36	(90.0)		
Clinical features						
Abdominal pain	Yes	174	162	(93.1)	4.05 [1.11, 13.18]	*p* = 0.0202 *
	No	26	20	(76.9)		
Diarrhoea	Yes	90	84	(93.3)	1.71 [0.56-5.80]	*p* = 0.4268
	No	110	98	(89.1)		
Abdominal distension	Yes	24	23	(95.8)	2.46 [0.35-107.18]	*p* = 0.3330 †
	No	176	159	(90.3)		
Vomiting	Yes	54	52	(96.3)	3.20 [0.71-29.54]	*p* = 0.0885†
	No	146	130	(89.0)		

Note. OR= Odds ratio; CI = Confidence interval; * Significant † Fisher's exact test

with rising age, from 36% in children less than 6 years up to 43.7% in children older than 10 years. At the same time, the risk of infection with *Trichuris* was higher in the group of children older than 10 years old [OR 4.08 CI, 1.11, 18.53] (Table 2). The prevalence of *Necator americanus* infection, the only specie of hookworm found, apparently increased in children in primary schools; however, a statistical analysis was not performed because of the small number of cases (data not shown).

The prevalence of *Giardia* was higher in those younger than 6 years of age (48%). Younger children were also at most risk to be infected than older children with ages between 6 and 10 years [OR 3.42; CI, 1.26, 9.13] (Table 2). In the case of *E histolytica/E dispar* infections, differences were not found among different age groups.

Table 2: Main helminthic infections and pathogenic intestinal protozoa diagnosed according to age of children in San Juan y Martinez

Species-age (in years)	*Total*	*Infected* No	(%)	OR	95% CI	*p* value
A lumbricoides						
< 6	25	9	(36)	Reference	Reference	
6–10	127	51	(40.1)	1.19	0.45–3.31	*p* = 0.8690
> 10	48	21	(43.7)	1.38	0.46–4.29	*p* = 0.6980
T trichuria						
< 6	25	4	(16)	Reference	Reference	
6–10	127	46	(36.2)	2.98	0.92–12.60	*p* = 0.0370 †
>10	48	21	(43.7)	4.08*	1.11–18.53	*p* = 0.0153 †
G lamblia						
< 6	25	12	(48)	3.42*	1.26–9.13	*p* = 0.0108
6–10	127	27	(16.1)	Reference	Reference	
> 10	48	11	(22.9)	1.10	0.45–2.58	*p* = 0.9747
E histolytica/E dispar						
< 6	25	1	(4)	2.60	0.04–51.47	*p* = 0.4190 †
6–10	127	2	(1.1)	Reference	Reference	
> 10	48	3	(6.2)	4.17	0.46–50.89	*p* = 0.1276 †

Note. OR = Odds ratio; CI = Confidence interval
*Significant † Fisher's exact test

DISCUSSION

As was observed in a previous study (4), IPIs are highly prevalent in SJM. The risk factor strongly associated with these infections was the children's zone of residence. The results of the present study are in agreement with that obtained in Albania (5) and in Turkey (6) in which residence in rural areas was found associated with these infections. This was not a surprise since STHs were the majority of infections diagnosed. These infections are also mainly transmitted when defecation occurs in the open (a very frequent practice in rural SJM) which leads to a high level of contamination of the environment and an increased possibility of acquisition of infection by a new host. Children in the rural SJM are likely to play in the environment nearby their homes and also some of them help their parents in agricultural work. A risk factor for IPIs in previous studies was the educational level of the parents (6–8), sometimes or never usage of toilet paper, washing anal area with hands after defaecation (6), large size of family or living in relatively crowded conditions (9–12), the level of sanitation and socio-economic status (9, 10, 12, 13) and poor personal health habits (13). All of these show that risk factors for IPIs may vary among different settings and populations. This is not unexpected if we take into consideration that these infections have multiple risk factors. Also, the lack of significant socio-economic factors may reflect the relative homogeneity of the study population and the fact that, at the community level, more proximate human factors determine IPIs risk. Studies in other municipalities and ages in Pinar del Río province would contribute to a clearer picture of the most relevant risk factors for IPI.

Intestinal parasitic infections are frequently reported as asymptomatic or "silent" infections. This means that a large number of persons in the community would not be identified and treated if there was not screening, they would therefore remain as a potentially infective pool in the population. Although we did not control the other potential causes of abdominal pain, we showed a strong association between parasitic infections and this symptom and the present result highlights its importance as a predictor of these infections in some populations. In a Venezuelan study, this symptom was also associated with *Ascaris* and *Blastocystis* infection (14), the two most frequently found IPI in this municipality (4). Other studies have shown symptoms related to IPI but others have failed to identify symptoms or signs significantly associated with STH. In an Ethiopian study, a morbidity questionnaire was employed to identify communities with a high prevalence of geohelminth infections and results indicate the potential of using reported 'worms' as a means of rapid assessment for identifying communities with a high prevalence of geohelminth infection, especially *Ascaris lumbricoides* and diarrhoea to identify *T trichuris* (15). However, in an earlier study in Tanzania, no symptom or sign was significantly associated with any geohelminth infection (16).

Concerning STH infections, *T trichuria*, the most prevalent intestinal parasitic infection in Cuba and the Caribbean region (17, 18) was more prevalent in the older children studied. Similar to the present study, other reports in Cuba document that this infection tends to reach a peak in childhood and early adolescence, followed by a stable decline to adulthood (17); the same has been observed in other geographical areas (19, 20). The reasons for this are not entirely clear but may include differences in host factors. It has been suggested that the prevalence of infection is decreased by prior exposure and the development of subsequent resistance acquired with age (21) but it could also be explained by age-specific variation in exposure (22).

Pathogenic intestinal protozoa were found in a number of children but *Giardia* infection was found to be increased in children before the age of 6 years compared with older children. This trend conforms to the findings of other studies (23, 24) and may have several explanations. First, the age-dependent decline in *Giardia* infection rates may be related to anti-*Giardia* immunity (24–26) and, secondly, the acquisition of better hygienic practices which makes the avoidance of this human protozoan infection easier (27).

Regarding *E histolytica/E dispar* complex, we did not find differences in the infection rates among the different age groups, however, these data should be considered with caution taking into consideration the small number of these infections and the wide confidence intervals. The overall rates of infection with *E histolytica*/*E dispar* were low and found to be similar to other studies carried out in Cuba (23, 28, 29), suggesting that infection with this complex is not high as in other countries. The techniques used in this study did not allow the differentiation between *E histolytica* and *E dispar* species; however, in a previous study of isoenzyme patterns of 42 isolates from Cuban patients, it was confirmed that *E dispar* was the only detected specie (30).

In summary, abdominal pain had a high sensitivity for prediction of IPIs and STHs in children from SJM. It is necessary to design the appropriate strategies to decrease the prevalence of IPI in this municipality.

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