Prevalence and Factors Associated with Intestinal Parasitic Infection among Schoolchildren from Jagüey Grande Municipality in Matanzas Province, Cuba

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ABSTRACT

Background: *Infections by intestinal parasites are a major public health problem worldwide, especially among children in developing countries. As the prevalence of parasitic infection is different among and within countries, there is a need for periodical prevalence evaluation to appropriate control strategies.*

Methods: *This cross-sectional study was carried out during October 2013 to estimate the prevalence of intestinal parasites and associated factors among school children attending "Juan Lefont Alonso" primary school from Jagüey Grande municipality in Matanzas province, Cuba. Three fresh faecal samples were collected from each child in different days. Parasite detection was achieved using direct wet mount, formalin-ether concentration, Ziehl-Neelsen permanent staining and Kato-Katz techniques. One hundred and seven children of third grade (8 to 9 years old, 56 males and 51 females) were included in the study after an informed consent form was signed by their parents or legal guardians. Questionnaire and observation were used to identify sociodemographic and associated factors. Data were analysed using EpiInfo 6.0 software.*

Results: *Fifty-five out of 107 screened schoolchildren (51.4%) were infected with one or more intestinal parasites. The most common parasites were* Giardia duodenalis *(39.2%; 42/107), Bastocystis sp (28%; 30/107),* Trichuris trichuria *(23.4%; 25/107) and* Ascaris lumbricoides *(19.6%; 21/107). Parasitic infection was similar by gender or place of residence. The risk of intestinal parasitic infection was significantly associated with the use of unboiled drinking water, and with bad hand washing practices as well as with the presence of diarrhoea and abdominal pain (*$p < 0.01$*).*

Conclusions: *The present study indicated that intestinal parasitic infections are common in this school and could negatively influence the quality of life of the community where the centre is located. In order to effectively reduce these infections, a multi-sectoral effort is needed.*

Keywords: Cuba, intestinal parasites, prevalence, risk factors

Prevalencia y Factores Asosciados con Infecciones Parasitarias Intestinales en Escolares del Municipio Jagüey Grande, Matanzas, Cuba

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RESUMEN

Objetivo: *Con el objetivo de estimar la prevalencia y los factores asociados con los parásitos intestinales en niños de tercer grado asistentes a la escuela primaria "Juan Lefont Alonso" del municipio Jagüey Grande en la provincia de Matanzas, Cuba en el mes de octubre de 2013.*

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DOI: 10.7727/wimj.2014.288

Material y métodos: *Tres muestras de materia faecal fueron recogidas por cada niño en días alternos. La identificación de las diferentes especies se realizó mediante el examen directo con lugol, eosina y solución salida, el método de concentración de Ritchie y los métodos de Ziehl-Neelsen y Kato- Katz. 107 niños de tercer grado (8- 9 años de edad, 56 niños y 51 niñas) fueron incluidos en el estudio luego de que sus padres o tutores legales consintieran en su participación. Los datos fueron almacenados y procesados utilizando el programa EpiInfo 6.0.*
Resultados: *Cincuenta y cinco niños (51,4%) estaban infectados por algún parásito o comensal siendo* Giardia duodenalis *(39.2%; 42/107),* Bastocystis *sp (28%; 30/107),* Trichuris trichuria *(23.4%; 25/107) y* Ascaris lumbricoides *(19.6%; 21/107) los más frecuentes. La ingestión de agua no hervida así como los malos hábitos de no lavarse las manos al salir del baño o antes de ingerir alimentos se asociaron significativamente con la presencia de infecciones parasitarias. Aquellos niños que tenían diarrea o dolor abdominal tenían riesgo mayor de infección (*p *< 0.01).*
Conclusiones: *Los resultados demuestran que las infecciones parasitarias intestinales son comunes en este centro educacional y podrían influir negativamente en la calidad de vida de la comunidad donde está localizado.*

Palabras clave: Cuba, Parásitos intestinales, prevalencia, factores de riesgo

West Indian Med J 2017; 66 (2): 362

BACKGROUND

The diseases caused by intestinal parasites (IP), once considered a phenomenon confined to the tropics, are now being diagnosed with increased frequency in Europe and other industrialized countries (1). Hundreds of millions of people are at risk of parasitic diseases worldwide. It is estimated that as much as 60% of the world's population is infected by intestinal parasites (2).

Intestinal parasitic infections are historically common in Cuba. In the country, despite of the implementation of government initiatives to improve socio-economic conditions, health, sanitation and water supplies, some parasitic infections, particularly intestinal protozoa, are still important causes of morbidity (3). This is particularly so in some high-risk groups, such as children attending day care, and preschool children in rural mountainous areas (4–6).

Although intestinal parasitic infections among children remain a global issue, the current information on such infections in schoolchildren in Matanzas province is non-inexistent in scientific journals. Previous studies carried out in the province have been restricted to children attending day-care centres (6, 7), a case report on a neglected tropical disease [Fasciolosis] (8), a clinical trial (9) and a study in a psychiatric institution (10). As the prevalence of parasitic infections is different among countries and within them, there is a need for periodical prevalence evaluation to appropriate control strategies. Considering that IP are the most common cause of parasitic diseases, and they cause significant morbidity and mortality, particularly in endemic areas and the limited information about them in our territory, we decided to estimate the prevalence of IP and associated factors among third grade schoolchildren attending to "Juan Lefont Alonso" primary school from Jagüey Grande municipality in Matanzas province, Cuba.

SUBJECTS AND METHODS

A cross-sectional study was carried out during October 2013 by researchers from the Municipal Centre of Hygiene, Epidemiology and Microbiology in Jaguey Grande municipality and the Provincial Centre of Hygiene, Epidemiology and Microbiology in Matanzas city, Matanzas, Cuba.

One hundred and seven children from eight to nine years of age, the entire third grade attendants to "Juan Lefont Alonso" primary school, were included in the study. The institution belongs to the urban area of the municipality. The study population was selected according to the World Health Organization (WHO) recommendations for deworming programmes (6).

A questionnaire was administered by researchers to each parent or legal guardian. The information collected through the questionnaires, included sociodemographic information such as age, gender of children and parents or legal guardians' education level. Behavioural habits of each child *(ie*, boiling water, washing hands before eating, washing hands after defaecation and eating raw

vegetables) or previous health conditions with history of symptoms (*eg*, diarrhoea and abdominal pain) were also collected. Environmental conditions such as place of living and existence of animals in households were documented. The information was used to assess the potential factors for IP. All children were apparently in good health and had no history of medication one-month before the study commencement.

Collection of faecal samples

Three faecal samples from each child were collected in wide mouth screw capped containers free of preservative at intervals of two days. The samples were collected by parents, relatives or by the educator and immediately sent to the Department of Parasitology of the Municipal Centre for Hygiene, Epidemiology and Microbiology in Jaguey Grande.

Four slides of each sample were prepared and examined by two analysts (one technician and one medical parasitologist); such that eight slides per sample were analysed. Three fresh faecal samples were collected from each child in different days and were examined by direct wet mount and formalin-ether (Ritchie) techniques. Kato-Katz was used when analysing the first sample of each child. The intensity of each soil-transmitted helminth infection was expressed as the mean of eggs per gram counts of the sample. Modified Ziehl-Neelsen stain technique was additionally used for coccidian parasites identification. The quality control was carried out at the Provincial Centre of Hygiene, Epidemiology and Microbiology in Matanzas city. All positive cases and 5% of negative samples were included in the quality control process.

All families and educators received the results of the laboratory diagnosis. The positive cases were referred to appropriate healthcare units, where they received specific treatment and follow-up.

Data derived from questionnaires and parasitological examinations were analysed using EpiInfo 6.0 software (Public Health Domain Software, CDC, Atlanta, GA, USA). Initial data entry was cross-checked by two independent individuals in order to be sure that data were entered correctly.

Prevalence was determined on the basis of combined results from the different diagnostic methods. For descriptive data, rate (percentage) was used to describe the characteristics of the studied group, including the prevalence of intestinal parasites according to age and gender.

A Pearson's Chi-square on proportion was used to test the associations between each variable. In univariate statistical model, the dependent variable was prevalence of intestinal parasites, while the independent variables were sociodemographic, behaviour, environmental sanitation and living condition characteristics. A significant level of $p < 0.05$ was adopted, relative risk (RR) and 95% confidence interval was computed by the analysis.

Ethical clearance was granted by the Research Ethics Committee of the Provincial Centre of Hygiene, Epidemiology and Microbiology in Matanzas City, Cuba.

The enrolment also required that an agreement model be signed by one of the child's parents or legal guardians, after being fully informed about the aim of the study. Instructions on how to collect the faeces were also provided in writing to the parents or legal guardians of the children. Prior to sample collection, a brief explanation of the aims of study was given to all parents or legal guardians who voluntarily accepted children participation. We also ask for permission from the school authorities before the commencement of the study.

RESULTS

A total of 321 samples were collected, three from each schoolchild. Of these patients (107), 56 were males and 51 were females. The overall prevalence of parasitic infection was 51.4% (55/107) with similar distribution by gender.

The prevalence of each parasite is indicated in Table 1. *Giardia duodenalis* had the highest infection rate (39.2%; 42/107) followed by *Bastocystis* sp (28%; 30/107), *Trichuris trichuria* (23.4%; 25/107), and *Ascaris lumbricoides* (19.6%; 21/107), respectively. Other intestinal parasites notified were *Endolimax nana* (11.2%; 12/107), *Entamoeba coli* (10.3%; 11/107), *Iodoamoeba buetschillii* (8.4%; 9/107), *Entamoeba histolytica/E dispar* (8.4%; 9/107), *Strongyloides stercoralis* (7.5%; 8/107), *Cystoisospora belli* (7.5%; 8/107) and *Cryptosporidium* sp (6.6%; 7/107). Only light infections were found when evaluating the intensities of *A lumbricoides* and *T trichuria* using Kato-Katz method.

Univariate analysis identified three factors associated with intestinal parasitic infections (Table 2) which include not washing hands before eating (RR = 2.53, 95% CI 1.22, 5.26), not washing hands after defaecation (RR = 2.17, 95% CI 1.23, 3.81), and drinking unboiled water (RR = 4.15, 95% CI 2.46, 7.00). Children who had diarrhoea (RR = 2.60, 95% CI 1.73, 3.89) and abdominal

Table 1: Prevalence of intestinal parasite infections according to species (n = 107).

Parasite species Protozoa	Infected	% (CI 95%)
Giardia duodenalis	42	39.2 (30.3 – 48.7)
Blastocystis sp	30	28 (20.1 – 37.1)
Endolimax nana	12	11.2 (6.2 – 18.2)
Entamoeba coli	11	10.3 (5.5 – 17.1)
Entamoeba histolytica/E. dispar	9	8.4 (4.1 – 14.8)
Iodoamoeba buetschillii	9	8.4 (4.1 – 14.8)
Cystoisospora belli	8	7.5 (3.5 – 13.7)
Cryptosporidium sp	7	6.6 (2.9 – 12.5)
Helminths		
Trichuris trichuria	25	23.4 (16.0 – 32.0)
Ascaris lumbricoides	21	19.6 (12.9 – 27.9)
Strongyloides stercoralis	8	7.5 (3.5 – 13.7)

pain (RR = 2.20, 95% CI 1.41, 3.42) had higher infection rate too.

The existence of animals in households (RR = 0.78, 95% CI 0.53, 1.16) and the practice of eating raw vegetables (RR = 1.05, 95% CI 0.70, 1.56) were factors not associated to the presence of IP in this population. The risk of having IP was similar in children living in rural or urban areas (RR = 1.58, 95% CI 0.89, 2.79).

DISCUSSION

Despite public health campaigns, improvement in the level of education, and the availability of and access to medical services, intestinal protozoa and soil-transmitted helminths are major problems of health worldwide (11). It is known that the transmission of enteroparasites depends on the presence of infected individuals, sanitation deficiencies and, principally, the socio-economic and cultural conditions of the population. There is an abundance of epidemiological data on the department and prevalence of intestinal parasitic infections in developing areas (11–13), in industrialized countries these infections are now more reported (14).

The prevalence of IP was found to be high in this study since half of participants harboured one or more parasite species in their intestine. Several possible explanations for this finding include the facts that these infections may be more easily identified when the number of faecal samples obtained from each individual is increased and when concentration methods are employed (11).

Different studies have been assessing the prevalence of intestinal parasitic infections in schoolchildren. Most of them, carried out in low-income countries, have differences with the number of samples analysed and the

Table 2: Factors association with intestinal parasitic infections among schoolchildren in Matanzas, Cuba

Variables		Infected	RR (95% CI)	*p*-value
Washing hands before eating	yes	6	2.53 (1.22 – 5.26)	0.00220*
	no	45		
Eating raw vegetables	yes	23	1.05 (0.70 – 1.56)	0.81554
	no	28		
boiling water	yes	12	4.15 (2.46 – 7)	0.00000*
	no	39		
Washing hands after defaecation	yes	10	2.17 (1.23 – 3.81)	0.00188*
	no	41		
Existence of animals	yes	25	0.78 (0.53 – 1.16)	0.22443
	no	26		
Diarrhoea	yes	31	2.60 (1.73 – 3.89)	0.00000*
	no	20		
Abdominal pain	yes	34	2.20 (1.41 – 3.42)	0.00017*
	no	17		

Note. RR = Relative risk; CI = Confidence interval; *Significant.

techniques used. Fentie *et al* (13) in a cross-sectional study conducted in northwest Ethiopia, demonstrated that 71.3% of the study population was infected with one or more IP. Similar high results were reported by Tagajdid (15) in a Moroccan urban primary school (61.7%). In Cuba, a study published in 2007 (11), repeated a high-prevalence of intestinal parasites among 200 children attending educational institutions of San Juan y Martinez municipality in Pinar del Rio province. Ninety-one per cent of the study population, a representative sample of the entire schoolchildren in the municipallity, was infected and 64.5% were poly-parasitized.

On the other hand, a study carried out in Iran (16), notified less prevalence; 28.8% of the schoolchildren included were infected with one or more IP. This prevalence is, however, unacceptable if we consider the amount of knowledge and evidence obtained by health professionals related with the control and even eradication of intestinal parasitic infections.

It is common in Cuban rural communities to use metronidazole or mebendazole when children have abdominal pain or a diarrhoeal episode that is why, in our opinion, only light infections were found when evaluating the intensities of *A lumbricoides* and *T trichuria*.

As intestinal parasitic infections are preventable, the high-prevalence rates notified around the world may suggest inadequate preventive measures and/or undue emphasis on cure rather than prevention. There is need for intersectoral actions to prevent the spread of IP so health authorities as well as stakeholders, politicians and the civil society should work together.

This study showed a significant association between low personal hygiene practices (washing hands before eating, washing hands after defaecation and drinking unboiled water) with intestinal parasitic infections and demonstrate, once more, the need to entrench good hygiene habits in the first years of life. The association has been reported in other regions around the world (17, 18). 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 (5). Although we did not control the other potential causes of abdominal pain or diarrhoea, we showed a strong association between parasitic infections and these symptoms. Our results highlight their importance as predictors of intestinal parasitic infections in high-prevalent settings.

The lack of *Enterobius vermicularis* in this group may be justified because of the use of a non-specific method for diagnosis. Few studies concerning the frequency of IP in children identified *E vermicularis* eggs by the Graham method (anal swab), so the true prevalence of this worm could be underestimated worldwide.

The present study demonstrates the importance of periodical surveys in schoolchildren considering that IP is highly prevalent in this group. This kind of research could be the way to identify infected children and prevent, with their treatment, educational activities, and follow-up visits, the possible negative effect of IP on their growth and development as well as the negative influence on community.

CONCLUSION

This study presents an accurate snapshot of intestinal parasitic infections in the third grade attendants to "Juan Lefont Alonso" primary school, and their high-prevalence calls for more awareness and control measures. As intestinal parasitic infections could negatively influence the quality of life of the community where the centre is located, a multi-sectoral effort is needed to revert the situation.

ACKNOWLEDGEMENTS

The authors thank the Scientific Council on the Centre of Hygiene, Epidemiology and Microbiology – Matanzas City, Cuba for their collaboration in this study. We also wish to thank those persons who helped with technical assistance and those who edit the manuscript.

Authors' contributions

R Cañete and P Rodriguez conceived and designed the study; Y Campos, R Valdes and R Cañete performed the experiments, coordinate and supervise data collection; all authors analysed and interpreted the data; R Cañete and R Valdes drafted the paper; P Rodriguez and Y Campos critically revised the paper. All authors read and approved the final paper.

Funding

This study was supported by grants from the institution of affiliation of the authors. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests
The authors have declared that no competing interests exist.

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