Journal of Infection and Public Health (2015) 8, 80—89

http://www.elsevier.com/locate/jiph

Potential impact of macroclimatic variability on the epidemiology of giardiasis in three provinces of Cuba, 2010—2012

Angel A. Escobedo[a,b,c], **Pedro Almirall**[d], **Raisa Rumbaut**[e], **Alfonso J. Rodríguez-Morales**[b,f,g,*]

[a] *Department of Parasitology, Hospital Pediátrico Universitario ''Pedro Borrás'', La Habana, Cuba*
[b] *Working Group on Zoonoses, International Society for Chemotherapy, Aberdeen, United Kingdom*
[c] *Committee on Clinical Parasitology, Panamerican Association for Infectious Diseases (Asociación Panamericana de Infectología), La Habana, Cuba*
[d] *Analisys and Health Trends Unit, Unidad Municipal de Higiene, Epidemiología y Microbiología, Plaza, La Habana, Cuba*
[e] *Ministerio de Salud Pública, La Habana, Cuba*
[f] *Research Group Public Health and Infection, Faculty of Health Sciences, Universidad Tecnológica de Pereira (UTP), Pereira, Risaralda, Colombia*
[g] *Committee on Zoonoses and Hemorrhagic Fevers of the Colombian Association of Infectious Diseases (Asociación Colombiana de Infectología, ACIN), Bogotá, Colombia*

Received 20 January 2014; received in revised form 10 June 2014; accepted 13 June 2014

KEYWORDS
Giardiasis;
Ecoepidemiology;
Climate Change;
Cuba

Summary Climate change and variability are common phenomena affecting various infectious diseases. Many studies have been performed on vector-borne diseases; however, few studies have addressed such influences on intestinal parasitic diseases (e.g., giardiasis). In this study, using nonlinear Poisson regression models, we assessed the potential associations between macroclimatic variation and giardiasis cases in children and school workers from three provinces of Cuba in the context of large sampling and parasitological assessment. Between 2010 and 2012, 293,019

* Corresponding author at: Research Group Public Health and Infection, Faculty of Health Sciences, Universidad Tecnológica de Pereira (UTP), Pereira, Risaralda, Colombia. Tel.: +57 3008847448.
E-mail addresses: arodriguezm@utp.edu.co, ajrodriguezmmd@gmail.com, ajrodriguezm_md@hotmail.com (A.J. Rodríguez-Morales).

http://dx.doi.org/10.1016/j.jiph.2014.06.001

subjects were assessed, resulting in 6357 positive for *Giardia* (216.95 cases/10,000 pop.; 95%CI 211.7—222.2). The variation in time for those giardiasis rates ranged from 35.8 to 525.8 cases/10,000 pop. Nonlinear Poisson regression models between the ONI index and the giardiasis incidence indicated a significant association ($p < 0.01$). With lower values of ONI, lower incidence of giardiasis was observed at Havana (pseudo $r^2 = 0.0576$; $p < 0.001$) and Guantánamo (pseudo $r^2 = 0.0376$; $p < 0.001$). Although these results are preliminary and the magnitude of association is not higher, the results were of statistical significance. This result indicates the need to assess in detail in further studies the impact of additional macroclimatic and microclimatic variables on the epidemiology of this still important intestinal parasitic disease, not only in Cuba but also in other countries of the Caribbean and Latin American region.

Introduction

Giardia lamblia (synonymous with *G. intestinalis* and *G. duodenalis*) is probably the most frequent pathogenic intestinal protozoan found in children and adults throughout the world. This flagellated organism, when present in the gut of human beings, is associated with diarrhea, abdominal cramps, weight loss, nausea and vomiting [1].

Both the duration and severity of *Giardia* infection are extremely variable, requiring in some cases hospitalization [2—4]. Fortunately, for the majority of infected persons, the symptoms generally subside within 2—3 weeks in otherwise healthy individuals. However, in some cases, this infectious disease has long-term consequences, including chronic diarrhea with or without intestinal malabsorption, recurrent abdominal pain and weight loss [1,5].

Data from surveys, excluding documented outbreaks, indicate that in industrialized countries, the prevalence rate of *Giardia* infection ranges between 2% and 5%; in contrast, it varies from 20% to 30% in developing countries [1]. Data on the prevalence of giardiasis in many countries is limited, as is the case for Cuba. However, in Cuba, the last national survey performed in 2009 found an overall prevalence of *Giardia* infection estimated at a level of 6.02% [6], similar to the 7.2% found in the previous national survey performed in 1984 (unpublished report). Despite this decrease, higher rates of prevalence were found among young children attending day-care centers and primary schools [7—10], which is presumably related to the poor hygiene of such children and the way this facilitates the fecal—oral transmission of *Giardia* cysts.

Similar to vector-borne infectious diseases [11,12], food-borne (parasitic and non-parasitic) infections could be associated with multiple factors, including changes in environmental and social elements that may influence their epidemiology [12,13]. In particular, the effects of climate change and variability have been studied in many vector-borne diseases, such as malaria [14], dengue [11,12] and leishmaniasis [15], but not for intestinal protozoan diseases, such as giardiasis.

If climate is influencing the epidemiology of such diseases, environmental control efforts are necessary, which requires an integrated and systematic approach at both the national and community level to reduce and mitigate the impact on disease epidemiology; such efforts are obviously linked to educational programs and other interventional measures [16].

The climate may also influence the complex interacting factors, including where *Giardia* cysts can be found and favored; in this way, the possibility to produce disease could be increased significantly. This influence of climate on the spread of *Giardia* infection could be an interesting subject of investigation.

A Mexican study, using data from the period of 1976 to 1988, analyzed the seasonality of giardiasis at the national and state levels and found that for that period, this disease had a stable pattern of highest incidence in the months of July and August for the country and in 11 states of the country [17].

Based on the above-mentioned background, in this first study, we assessed the potential associations between macroclimatic variation and giardiasis cases in the context of a provincial parasitological survey in three different geographical settings of Cuba.