REVIEW ARTICLE

Epidemiological aspects of strongyloidiasis in Brazil

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(*Received 6 June 2011; revised 16 June 2011; accepted 19 June 2011; first published online 3 August 2011*)

SUMMARY

The objective of this review was to outline an epidemiological profile of *Strongyloides stercoralis* by parasitological and serological diagnosis in inhabitants, and to associate this profile with different immunosupression situations, in Brazil, over 20 years (1990–2009). The occurrence of *S. stercoralis* using parasitological methods was 5·5%, being 4·8% in rural and 5·0% in urban areas, characterizing the country as hyperendemic. There was a diversity of techniques used as a diagnostic tool and only 39·1% of the studies presented results based on at least 1 specific method. The occurrence increased with age, being 12·1%, for those over 60 that suggests an epidemiological condition of concern for the elderly population. Of the seroepidemiological studies in the general population the mean positivity in serum samples was 21·7% and 29·2%, using an immunofluorescence antibody test and enzyme-linked immunosorbent assay (ELISA), respectively. The occurrence of strongyloidiasis in immunosuppressed individuals was 11·8% by parasitological methods and 19·5% using immunological methods. Considering that Brazil is a tropical country and that the character of chronicity and autoinfection of the parasite that can result in severe forms of hyperinfection or dissemination makes strongyloidiasis an important medically and socially neglected problem.

Key words: strongyloidiasis, epidemiology, prevalence, Brazil.

INTRODUCTION

Strongyloides stercoralis (Bavay, 1876) is an intestinal nematode, which causes strongyloidiasis, helminthiasis usually responsible for chronic asymptomatic infections of the gastrointestinal tract in immunocompetent human hosts and may remain undetected for decades. In immunocompromised patients due to immunosuppressive therapy (particularly steroids) (Genta, 1992; Keiser and Nutman, 2004; Lam *et al*. 2006), infection with human immunodeficiency virus (HIV) (Ferreira, 2003; Keiser and Nutman, 2004; Silva *et al*. 2005), infection with human T-lymphotropic virus 1 (HTLV- 1) (Porto *et al*. 2002; Keiser and Nutman, 2004), solid organ transplantation (Keiser and Nutman, 2004; Concha *et al*. 2005), haematological malignancies (Graeff-Teixeira *et al*. 1997; Keiser and Nutman, 2004), solid-organ malignancies (Safdar *et al*. 2004), hypogammaglobulinaemia (Keiser and Nutman, 2004), chronic alcoholism (Oliveira *et al*. 2002; Silva *et al*. 2005; Marques *et al*. 2010) severe malnutrition (Keiser and Nutman, 2004) or diabetes mellitus (Mendonça *et al*. 2006), this infection may develop into a hyperinfection syndrome or disseminated disease (Keiser and Nutman, 2004; Marcos *et al*. 2008).

This parasite infects humans through skin penetration, and has a complex life cycle involving 2 stages of development: a phase of free-living that occurs in the environment, good conditions of temperature and humidity, and the other stage as a parasite, which occurs within the host. The parthenogenetic female of *S. stercoralis* lays few eggs per day, which are deposited in the intestinal epithelium, the rhabditiform mature larvae exit in the feces of the patients, and constitute in the diagnostic stage viewed in optical microscopy. By a process of autoinfection, there may be a rapid increase in the number of infective larvae; strongyloidiasis consequently persists for decades (Grove, 1996; Costa-Cruz, 2005). The fact that the free-living forms of the parasite in the soil depend on favourable environmental conditions such as humidity and high temperature, makes conditions in many regions of Brazil ideal for the development and maintenance of intestinal parasites (Carmo *et al*. 2005).

Definitive diagnosis of strongyloidiasis is performed mainly by the identification of larvae in fecal specimens, through concentration techniques or culture methods. Nevertheless, these larvae are excreted

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 © Cambridge University Press 2011
doi:10.1017/S003118201100120X

in low numbers and not daily, making the parasitological methods unreliable in most cases, requiring the analysis of 7 stool samples to increase the positivity (Dreyer *et al*. 1996; Uparanukraw *et al*. 1999). Several techniques are described for the parasitological diagnosis of strongyloidiasis, including the modified Baermann method by Moraes (BM) (Baermann, 1917; Moraes, 1948), the method of Rugai (R) (Rugai *et al*. 1954), Harada-Mori (HM) (Harada and Mori, 1955) and culture method on agar plates (AP) (Arakaki *et al*. 1988). However, the increased number of stool samples and the inconvenience of fresh stool specimens, make these parasitological diagnostic methods unusable in routine laboratory practice. Larvae can also be found in other body fluids (sputum, broncho-alveolar lavage, among others), through endoscopy, colonoscopy, or intestinal biopsy (Costa-Cruz, 2005; Minematsu *et al*. 2011). The failure to diagnose this parasitosis is reflected in the frequent reports of fatal cases associated with hyperinfections, brought on by corticosteroid therapy. The similarity between corticosteroids and an ecdyses hormone of the parasite, which promotes maturation of infective larvae in the intestine of the patient, is a possible explanation for this association (Hernandez-Chavarria, 2001). Thus, the serological methods present a good alternative for early diagnosis and for evaluating the effectiveness of treatment (Sato *et al*. 1995; Paula *et al*. 2000; Siddiqui and Berk, 2003; Costa-Cruz, 2005; Page *et al*. 2006; Sudré *et al*. 2006; Varatharajalu *et al*. 2011).

Many epidemiological aspects of *Strongyloides* infection are not well known, such as prevalence rates that can be expected in different sectors of the population, environmental and zoonotic aspects, geographical variations, besides transmission and clinical presentation, host immunity and the risk factors for dissemination. The prevalence of *S. stercoralis* is underestimated, especially by the low sensitivity of parasitological diagnostic methods employed in routine procedures that do not include specific methods to search for larvae, and also the shortage of parasitological surveys. Thus, *S. stercoralis* infections in many areas remain without information (Hernandez-Chavarria, 2001; Olsen *et al*. 2009). Strongyloidiasis has a heterogeneous worldwide distribution, and prevalence has been divided into 3 categories: sporadic (<1%), endemic (1–5%) and hyperendemic (>5%) (Pires and Dreyer, 1993). It is estimated that strongyloidiasis affects 30–100 million individuals around the world. All hyperendemic areas are located in the tropics, the endemic areas in the subtropics, but the parasite is also present, sporadically, in the United States, Europe and Asia (Olsen *et al*. 2009).

The World Health Organization (2005) recommended that the *Strongyloides* infection could be included in the 'Parasite Control Program' in areas where the infection is endemic. However, now the infection is only a possible target and presumably, not effectively integrated in helminth control programmes. Recognizing that intestinal parasites are still prevailing in the country, the Brazilian government created the National Surveillance and Control of Enteroparasitoses in 2005 (Carmo *et al*. 2005) and in 2007, the Growth Acceleration Program (PAC) (Ministério da Fazenda, 2007) providing for actions in sanitation, targeting the reduction of infectious and parasitic diseases, including intestinal parasitosis.

Despite scientific knowledge and technological advances available for its treatment and prevention, strongyloidiasis is still a parasitic disease of great importance to public health in Brazil, but information on strongyloidiasis is based on studies that show local epidemiological data. The objective of this review is to outline an epidemiological profile of this intestinal helminth in Brazil by parasitological and serological diagnosis in inhabitants of rural and urban areas, and associate this profile with different immunosuppression situations.

METHODOLOGY

We conducted a review of the literature on epidemiological aspects of strongyloidiasis in Brazil, using the keywords '*Strongyloides stercoralis*', 'strongyloidiasis', 'intestinal parasites' and 'Brazil' in different combinations. We searched in the Scientific Eletronic Library Online (SciELO) and the U.S. National Library of Medicine (PubMed) over 20 years (1990–2009). There have been many studies regarding intestinal parasites from which the specific results for *S. stercoralis* were extracted. We used as inclusion criteria any study that gave values of the occurrence of *S. stercoralis* in Brazil in accordance with the region, location by state, rural and urban areas, considering the population by age, immunity, the method of diagnosis, or parasitological and serological association with other diseases (alcoholism, diabetes, cancer, infection with AIDS/HIV and HTLV-1, among others). As exclusion criteria: any study published before 1990 and after 2009, and papers that did not show the occurrence of *S. stercoralis*, when we used the keyword 'intestinal parasite'. To analyse the information the value of the mean (X) frequencies reported was chosen.

RESULTS AND DISCUSSION

Epidemiological profile of S. stercoralis *by parasitological methods*

In the period from 1990 to 2009 it was found that the occurrence of infection by *S. stercoralis* in Brazil, using parasitological methods of diagnosis was 5·5%, characterizing the country as a hyperendemic area for

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