The Prevalence of Enteropathy Due to Strongyloidiasis in Puerto Maldonado (Peruvian Amazon)

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Human strongyloidiasis is an important health problem in the southeast region of Peruvian Amazon, due to its prevalence and long term morbidity. An epidemiological study was conducted in the Peruvian Amazon area of Puerto Maldonado to determine the prevalence of strongyloidiasis in the population. Stool samples were collected from 1,133 patients at the outpatient department of our clinic. Strongyloidiasis affected 221 examined patients (20%). Prevalence was highest in males, mostly in children and elderly men. People living in urban and marginal urban areas, those coming from outside the region, and Andean people, showed the highest prevalences. Pre-school children were more likely to be parasitized than older children. The most common symptoms were diarrhea (55%), abdominal pain (32%) and cough (53%). One in 7 (13%) affected patients presented with moderate or severe symptoms, including life-threatening complications. Other intestinal parasites were found frequently in patients diagnosed with strongyloidiasis. Improved human waste disposal services are considered to be the main requirement to reduce the high prevalence of this disease.

Key Words: *Strongyloides stercoralis*, epidemiology, enteropathy, Peruvian Amazon.

Strongyloidiasis is a widely spread soil-transmitted infection with *Strongyloides stercoralis.* It is a worm inhabiting the small bowel of humans who live in large areas of the tropics and subtropics, and it can occur in mines of temperate climates. One of the properties of this nematode is its ability to propagate in a host by internal autoinfection. This nematode is undoubtedly one of the most versatile of all human parasites in that it may exist indefinitely as a free-living parasite with both sexes present, or as a self-perpetuating parasitic population of females that reproduce through parthenogenesis (monosexual reproduction) [1].

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The strongyloidiasis prevalence rate is dependent on the geographical area, environmental safety conditions, quality of housing, socio-economic status, standards of hygiene in the community, crowding, and physical and chemical characteristics of the soil, temperature, humidity, vegetation, etc. [2-5]. In poor countries, deficient nutrition can damage the intestinal mucosa and affect humoral and cellular immunity, creating favorable conditions for the parasite. Parasites also exacerbate the protein, caloric, and vitamin deficiencies. In the present study, we attempted to determine the prevalence of strongyloidiasis by stool examination in symptomatic patients in Puerto Maldonado (Peruvian Amazon).

Materials and Methods

Geographical location

The geographic area of Puerto Maldonado (Peru), also includes Tambopata and Las Piedras

districts, part of Inambari and part of Tahuamanu districts, and all regions the Madre de Dios Department.

Socio-demographic characteristics

The last census data (1994) showed a total population of 46,736 inhabitants; 15,489 were living in rural areas and 31,249 in urban and marginal urban areas of Puerto Maldonado. Public water supply, sewerage and waste removal services were only available for 13,400 inhabitants.

Subjects

Stool parasitological examination was made when patients presented with diarrhea of more than 24 hrs duration, or accompanied by mucus, blood or pus, when symptoms or signs of anemia were manifested, when abdominal pain was not connected to another cause, or when spontaneous elimination of worms by mouth or anus occurred. Data concerning age, sex, origin, place of residence, culture, language, and occupation were also reported. Total population studied in the outpatient department was 5,354 of whom 3,013 were female and 2,341 were male. Parasitological studies were carried out in 1,133 subjects, 587 female and 546 male.

Parasitological diagnosis

To examine stools for rhabditoid larvae, three direct fecal smears with saline solution and with lugol, considered the conventional method, were performed. Stools specimens were microscopically studied (x 100) and infection was graded as light, moderate or severe when 1, 1 to 3, or more than 3 larvae per microscopical field were found. Stools were also examined for the presence of other parasites.

Results

A total of 221 patients were found to be positive for *S. stercoralis* from a total of 1,133 subjects studied. Their places of residence, and occupations are shown in Tables 1 and 2, respectively. Prevalence referred to the total population studied and was 3.2% in females and 5.2% in males.

Clinical manifestations were: diarrhea (55%), cough (53%), abdominal pain (32%), anorexia (23%), fever (23%), paleness (20%), nausea and/or vomiting (15%), general discomfort (10%) and borgborisms (5%). Symptoms were severe in 7% of studied patients, moderate in 6% and slight in 87%. In the last group, 46% had diarrhea and cough, 28% abdominal pain, and 23% suffered from fever.

People living outside the region (22%), within our region (19%), or transients (19%) all had similar infection rates. Different ethnic groups among the autochthonous shared different prevalences: Amazon people (7%), Andean people (24%) and others (19%). Endoparasites other than *Strongyloides* were also reported. Their frequencies are shown in Table 3.

Discussion

Communicable infections are the main stress on human health. Although special programs are focused on prevention and control of tropical diseases, they remain an important challenge in developing countries. Among these, intestinal parasitism often involves chronic, low-level infections. Human strongyloidiasis in the southeast region of the Peruvian Amazon is a severe health problem due to its prevalence and longterm morbidity. It is known that several factors determine whether a disease will affect a household's income and activities. These include the type of disease, the intensity of infection, the type of activities on which households and communities depend for their livelihood, and the occurrence of disease in relation to peak working activity [6]. The medical significance of strongyloidiasis as a fatal hyperinfection, under certain immunocompromised conditions, has also been reported [7, 8].

Parasitologic diagnosis based on coprologic examination is probably one of the most difficult problems in clinical parasitology. In spite of the use of direct fecal smears as a conventional method for detecting larvae in stool specimens, this method is not considered sensitive enough for diagnosis of chronic cases. In such cases, the larvae are present only

Table 1. Population distribution related to place of residence

Place of residence	No. People examined for parasites	No. people with Strongyloidiasis	Prevalence (%)
Marginal-urban	514	111	21.6
Rural	326	59	18.1
Urban	239	50	20.9

Table 2. Population distribution related to occupation

Occupational	Population examined for parasites	Population with Strongyloidiasis	Prevalence (%)
Motorcyclist	8	3	37.5
Nursing children	121	16	13.2
Pre-school children	300	75	25
School children	192	45	23.4
Student58	6	10.3	
Teacher11	0	0	
Minor 25	6	24	
Walking26	6	23.1	
Farmer121	23	19	
House maker	152	21	13.8

Table 3. Frequency of enteroparasites related to population under parasitological examination and population diagnosed with strongyloidiasis

Parasite	Parasites examined population	(%)	Population with strongyloidiasis plus other enteroparasite	Prevalence (%)
Strongyloides stercoralis	221	19.5		
Ancylostoma duodenale	308	27.1	104	47.1
Ascaris lumbricoides	328	28.9	94	42.5
Trichiuris trichiura	132	11.6	39	17.6
Hymenolepis nana	49	4.3	9	4.1
Giardia lamblia	188	16.7	46	20.8
Entamoeba hystolytica	217	19.1	45	20.3

in very small numbers, or are frequently absent from individual stool specimens thus complicating the diagnosis. In previous investigations, Jones [9] detected the larvae by direct smear in only 27% of the fecal samples collected from 100 patients who were proven to have strongyloidiasis by examination of duodenal fluid. A single stool examination was only 15% to 24% effective in confirming the infection of proven strongyloidiasis cases when the direct smear, formalin-ether concentration, and filter paper culture method, were used. Even when the examinations were repeated daily for 3 days, the reconfirmation rate was approximately 50% by direct smear and 45% by the concentration method. In a comparative study in which the efficacy of the direct smear, the Baermann method, and an agar plate culture were compared, it was reported that the diagnostic efficacy of the agar plate culture was as sensitive as that of the modified Baermann method. The Baermann method has some advantages in terms of cost-effectiveness and the time needed to obtain results [10]. In our laboratory, we were able to detect 46% of positive cases.

Prevalences of strongyloidiasis in the total population were 3.2% among females and 5.2% among males. In other Peruvian regions, prevalence of 6.12% [11] has been reported.

When prevalences in children under 5 years were studied, data reported were 16.3% in Tarapoto, Peru, [12], 4% in Maasai children in the Kenyan Rift Valley [13], 3.8% in eastern Sierra Leone [14], 2.6% in Honduras [15], 2.5% in Southeast Asian refugees living in the USA [16], and 1% among school food handlers in Uberlândia, Brazil, [17]. Our data were of 1.69% referred to the total population under 5 years and of 38.22% referred to the population under parasitological study.

Although *Strongyloides* affects all ages, our results show a young parasitized population with a mean age of 15.81 compared to the main age of consulting of 24.82. Prevalence was highest in childhood (22.81%) and in old age (12.82%), in contrast with previous data [18] that found it more prevalent in adults. Prevalence

was also higher in males (22.71%) than females (16.52%) in all the age groups with the exception of the oldest. No explanation has been found for this.

People living in crowded areas were the most parasitized with prevalences of 21.60% and 20.92% in marginal urban and in urban areas, respectively, in contrast to 18.09% found in rural areas, consistent with others studies [14]. Buchwald, et al. [16], also found an 11% prevalence of intestinal parasites among Southeast Asian refugees in the US, whereas infections were infrequent in Southeast Asians who had lived in the US for extended periods of time. Crowding and inadequate hygiene were involved. These might be the reasons for different prevalence among ethnic groups, and may also explain the results found among pre-school children (25%), school children (23.44%), seminar students (25%) and students (10%) or teachers (0%). A variety of occupations account for different prevalences. Those related to mining, gold extraction in river beds, being the most prevalent ones.

It is well known that positive fecal samples often involve more than 1 pathogen [19]. Our results showed that hookworms, *Giardia*, *Entamoeba* and *Trichuris* were prevalent in patients diagnosed of strongyloidiosis.

These results indicate active parasite transmission as a result of poor environmental hygiene largely ascribable to a lack of public water supply, sewage and waste removal services, mainly in rural areas. Marginal urban areas have similar conditions. The percentage of children with stools positive for parasites indicated the gross lack of personal hygiene and constant soil pollution. This no doubt resulted in repeated exposure and infections, with resultant high prevalences of intestinal parasites acquired during infancy and thereafter. Effective plumbing, rather than effective medical treatment, is the real line of defense against these versatile pathogens.

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