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## STUDY OF ENTEROPARASITES INFECTION FREQUENCY AND CHEMOTHERAPEUTIC AGENTS USED IN PEDIATRIC PATIENTS IN A COMMUNITY LIVING IN PORTO ALEGRE, RS, BRAZIL

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### SUMMARY

Parasitic infections caused by intestinal protozoan and helminths affect more than two billion people worldwide and chemotherapy is the most commonly used therapeutic procedure. Considering the problems created by parasitic infections and the incorrect use of drugs, the aim of this work was to detect the frequency of enteroparasites infection and to estimate the use of chemotherapeutic agents in children living in the periphery of the city of Porto Alegre, RS, Brazil. Ninety-six preschool age children, who had parasitological exams and who used antiparasitic drugs, were analyzed. The efficacy of treatment was evaluated by stool examination repeated six months after treatment. The same diagnostic test was used to evaluate parasitological cure, which was defined as absence of eggs and cysts in the stool. From these children, 79 (82.3%) were contaminated by some species of parasite, the most prevalent were *Ascaris lumbricoides*, *Trichuris trichiura* and *Giardia lamblia*. The most commonly used drugs were mebendazole (86% of prescriptions) and metronidazole (30.3%). The cure rate in the 79 children, examined 6 months after treatment, was 65.3% for *A. lumbricoides* and 66.1% for *T. trichiura*. This study suggests that a continuous education program regarding the prevention and treatment of parasitic infections is an essential tool for their eradication.

**KEYWORDS:** Chemotherapeutic agents; Drug utilization study; Pharmaceutical care; Parasitic infections.

### INTRODUCTION

Parasitic infections, caused by intestinal protozoan and helminths, affect more than two billion people worldwide<sup>28</sup>. These infections are more prevalent in the poorest sections of the population and re-infection in endemic areas is continuous<sup>5,6</sup>. According to the WHO, 980 million people are infected with intestinal roundworm *Ascaris lumbricoides*<sup>28</sup>. Several studies show that the prevalence of *A. lumbricoides* and *Trichuris trichiura* is very high in the patients examined, when compared with other parasites such as *Giardia lamblia*, *Strongyloides stercoralis*, *Hymenolepis nana* and others<sup>4,8,9,10,17,21,22,27</sup>.

Among the conditions influencing the development of these infections are poor sanitary conditions, lowering resistance of the host, population explosion, inadequate control of vectors and infection of reservoirs, increased migration, military operation and travelling around the world<sup>15,20,24</sup>. This disease can undermine child development, educational achievement, reproductive health and social and economic development<sup>1,3</sup> and some parasitic infections can cause morbidity and mortality<sup>14</sup>. Nevertheless, treatment is often neglected for economic reasons and because most patients have no symptoms<sup>1</sup>.

Chemotherapy is the cornerstone of the strategy of control of

morbidity, reduction of transmission and delay of soil-transmitted helminth re-infection<sup>3,11</sup>. The benzimidazole antihelminthics are largely used for treating intestinal nematode infection together with praziquantel for schistosomiasis<sup>7,16,19</sup>. These drugs are safe, inexpensive and very effective, have a broad-spectrum of activity, and easy administration<sup>3,15</sup>. Anthelmintic resistance may develop more slowly than in other agents, although, a recent study indicates that benzimidazole resistance has developed in hookworms after treatment of infected patients<sup>11</sup>.

Chemotherapy is the most used therapeutic procedure, however, many treatments do not obtain their goal due to the incorrect use of drugs<sup>25</sup>. Tests on the efficacy of chemotherapeutic agents can be used, these include cure rate, egg-reduction rate and the occurrence of any side effects due to administration of the drugs.

Therefore, actions by the health professional are necessary to provide adequate clinical care within the health system<sup>28</sup>. Pharmacists, in the modern health system, also have a responsibility to provide patient education regarding treatment as well as diagnostic investigation<sup>12</sup>. According to OLSEN *et al.*, health education is an important factor in the prevention of parasitic infections<sup>20</sup>.

Considering the problems created by parasitic infections and the

incorrect use of drugs, the aim of this work was to detect the frequency of enteroparasites infection and to estimate the use of chemotherapeutic drugs in children living in the periphery of Porto Alegre, RS, Brazil.

## MATERIALS AND METHODS

**Population:** Prospective data collection was performed during the year 2002-2003. Ninety-six children of pre-school age and of both sexes were analyzed, children were chosen randomly from the patients of a Public Health Center, Porto Alegre, RS, Brazil.

**Diagnostic test:** The fecal specimens were collected and screened for a complete ova and parasite examination (O&P) by the gravity sedimentation technique<sup>13,16</sup> and the Baermann method<sup>2</sup>. One sample from each patient was examined within a period of 12 h after the collection and parents signed an informed consent form. Immediately after the stool examination, treatment was given to the children with positive stool findings. The efficacy of treatment was evaluated by stool examination repeated six months after treatment. The same diagnostic test was used to evaluate parasitological cure, which was defined as absence of eggs and cysts in the stool.

**Pharmaceutical care program:** After the prescription of medication, an interview was performed with the patients and their parents. The questionnaire contained information on the patient's age, habits, prescribed drugs, and treatment regimen. The Pharmaceutical Care Program provided the patients and parents with information about basic health hygiene notions, drug prescriptions and the correct use of drugs. This study was approved by the Institutional Ethics Committee.

**Data analysis:** The data were collected and the results were kept in individual patient files together with the diagnostic tests, the questionnaires and interventions realized. The computer program, Epiinfo, was used to analyze the data and cure rate was presented as the percentage of the data set.

## RESULTS

In this survey, 96 children of pre-school age were investigated. Table 1 shows the characteristics of children infected, where the mean age of the female infected was 4.43 ( $\pm$  2.36) and the non-infected was 3.14 ( $\pm$  1.77). The mean age of the infected male children was 4.45 ( $\pm$  2.65) and the non-infected was 2.62 ( $\pm$  3.06). The total number of infected children before treatment was 79 (82.3%) and 17 (17.7%) non-infected. Of these, 46 (47.9%) were female infected children and 7 (7.3%) non-infected. The total number of male children infected was 33 (34.4%) and non-infected males was 10 (10.4%) (Table 1).

According to the results, 79 (82.3%) children were contaminated by some parasite. Table 2 shows the distribution of the specific enteroparasites, the most prevalent parasites were *A. lumbricoides* (49; 62%), *T. trichiura* (46; 58.2%) and *G. lamblia* (16; 20.3%) (Table 2). The children were infected with *Hymenolepis nana*, *Strongyloides stercoralis* and other protozoa.

Table 3 depicts the chemotherapeutic agents most commonly used in the infected patients. Of the 79 infected patients that received treatment with one or more chemotherapeutic agent, 68 (86.1%) received

**Table 1**

Sex and age composition prevalence, and intensity of parasites among pre-school age children in an urban slum, Porto Alegre, RS (n = 96)

Sex	Negative cases	Positive cases
Children's age F/M <sup>a</sup>	3.14 $\pm$ 1.77/ 2.62 $\pm$ 3.06 <sup>b</sup>	4.43 $\pm$ 2.36/ 4.45 $\pm$ 2.65
Female	7 (7.3%)	46 (47.9 %)
Male	10 (10.4%)	33 (34.4 %)
Total	17 (17.7%)	79 (82.3 %)

<sup>a</sup>F = female; M = male; <sup>b</sup>Mean  $\pm$  SD

**Table 2**

Parasites distribution in pre-school age children (n = 79)

Parasites	Frequency*	Percentage (%)
Helminths		
<i>Ascaris lumbricoides</i>	49	62.0%
<i>Trichuris trichiura</i>	46	58.2%
<i>Strongyloides stercoralis</i>	3	3.8%
<i>Hymenolepis nana</i>	5	6.3%
Protozoan		
<i>Entamoeba</i> spp.**	1	1.3%
<i>Entamoeba coli</i>	8	10.1%
<i>Endolimax nana</i>	6	7.6%
<i>Giardia lamblia</i>	16	20.3%

\*Some specimens had more than one parasite. \*\**Entamoeba histolytica* is being used to designate pathogenic zymodemes, while *E. dispar* is now being used to designate nonpathogenic zymodemes. However, unless trophozoites containing ingested red blood cells (*E. histolytica*) are seen, the two organisms cannot be differentiated on the basis of morphology.

anthelmintic mebendazole, 24 (30.4%) patients received metronidazole, 5 (6.3%) patients received praziquantel and 3 (3.8%) patients received anthelmintic tiabendazole. The most used drug was mebendazole with a treatment regimen of 600 mg multiple-dose (2 X 100 mg over three days). Other drug regimens used were 5 mg/kg three times a day during five to seven days for metronidazole to treat *Giardia lamblia*, and 10 mg/kg three times a day for five to seven days to treat *Entamoeba*. Praziquantel was used at 50 mg/kg once a day for *Hymenolepis nana*. To treat *Strongyloides stercoralis*, tiabendazole (25 mg/kg) was administered twice daily for two days (Table 3).

**Table 3**

Various regimens of chemotherapeutic agents in the treatment of parasitic infections (n = 79)

Regimen of chemotherapeutic agents	Number of prescription*	Percentage (%)
600 mg mebendazole multiple dose	68	86.1%
5 mg/kg metronidazole multiple dose	24	30.4%
50 mg/kg praziquantel single dose	5	6.3%
25 mg/kg tiabendazole multiple dose	3	3.8%

\*Some prescriptions had more than one chemotherapeutic agent prescribed.

There was an increase in the children's weight after the use of pharmacotherapy where 21 (12.9%) patients demonstrated an increased weight after treatment (data not shown).

Among the children studied the percentage cure rate at examination 6 months after treatment was 65.3% for *A. lumbricoides*, 66.1% for *T. trichiura* and 71.5% for *G. lamblia* (Table 4).

**Table 4**

Comparison between the intensity of *Ascaris lumbricoides*, *Trichuris trichiura* and *Giardia lamblia* infection in the pre- and post-treatment period in an urban slum, Porto Alegre, RS (n = 79)

Type of infection	Parasitic prevalence (%)		CR (%)
	Pre-treatment	Post-treatment	
<i>A. lumbricoides</i>	62.0%	34.7%	65.3%
<i>T. trichiura</i>	58.2%	33.9%	66.1%
<i>G. lamblia</i>	20.3%	18.5%	71.5%

CR = cure rate; defined as absence of eggs in the stool after treatment.

## DISCUSSION

According to our data, most of the children studied were found to be infected by some species of worm. This study was performed in the periphery of Porto Alegre, where families live in inadequate sanitary conditions, reservoirs and vectors are infected, and food and water are contaminated. Many children are more exposed to infections because they have poor hygienic habits and the houses are located near rubbish deposits. The majority of the children's parents, who have a low income, are analphabets, leading us to believe that the heavy intensity of worm infection is related to the low socioeconomic level of the population analyzed.

The high rate of use of mebendazole is justified by the high prevalence of the two intestinal parasites, *A. lumbricoides* and *T. trichiura*, in the children studied. It is important to mention that the Public Health Center did not have the anthelmintic, albendazole, available and the medications prescribed were given freely, which limited the choice of prescription.

The pharmacological regimen used in the Public Health Center followed a pattern largely used nowadays. All drug administrations were by oral route, with recommended dosage and frequency of administration according to the prescription. The children also received mineral oil, vitamins and ferrous sulphate to avoid iron-deficiency-related anemia. Each medication prescribed had its own drug regimen, with time of administration and variable doses. This created some difficulties for the parents in understanding how to administrate the drugs prescribed, resulting some times in the non-compliance of treatment. Several studies show that drug regimens with one single oral dose can be as effective and safe as the conventional regimens<sup>18,19,23</sup>. Various combinations of drugs are also suggested for the treatment of parasitic infections in some situations<sup>26</sup>. The current chemotherapeutic agents can be used in novel ways, whilst empiric regimens need continuous clinic evaluation, thus, improved investigations of the use of drugs with different mechanisms against the same parasite or broad-spectrum are needed.

Regarding medication-related problems, we found that some patients did not receive the therapy, or did not adhere to the indicated drug regimen because of lack of information. These problems are very common in people living in poor hygiene and health conditions, with little food, without education and knowledge of the importance of following treatment. Many children examined had already received pharmacological treatment at least six months before. The re-incidence of infection is common twice or three times a year and, therefore, the benefits of a continuous program for high-risk groups as well should be considered.

Nutritional status is an important factor for the adequate absorption and action of the drugs<sup>24</sup>. The majority of patients studied were undernourished, facilitating the process of adverse drug reactions. Thus, a strategy to avoid those side effects in this high-risk group would be the correct use of pharmacotherapy together with an appropriate diet. After the treatment there was a significant increase in the weight of some of the children (data not shown), which led us to believe that the drug therapy was correctly used.

The high cure rate percentage found in our study confirmed the high efficacy of the benzimidazole anthelmintic for *A. lumbricoides* and *T. trichiura* infections. For the other parasites, geographical variations, genetic differences in the parasites and the quality of drugs (for example low-quality generics) used should be taken into account to explain low cure rates<sup>3</sup>. In addition, we should look at the development of drug resistance, which would cause a decrease in the parasites cure rate as well<sup>11</sup>.

This study suggests that additional support and a continuing health education program, regarding prevention and treatment, is an essential tool for the eradication of the parasitic infections.

## RESUMO

### Estudo da frequência de infecções por enteroparasitos e agentes quimioterápicos usados em pacientes pediátricos em uma comunidade de Porto Alegre, RS, Brasil

As parasitoses provocadas por protozoários ou helmintos patogênicos afetam mais de dois bilhões de pessoas no mundo. Considerando os problemas gerados por infecções parasitárias e a necessidade do uso correto dos medicamentos prescritos, o objetivo deste trabalho foi detectar a frequência de infecção por enteroparasitos e o uso de agentes quimioterápicos em crianças moradoras na periferia de Porto Alegre, RS, Brasil. Foram analisadas noventa e seis crianças em idade pré-escolar, que realizaram o exame parasitológico de fezes e que fizeram uso de antiparasitários. A eficácia do tratamento foi avaliada pelo exame parasitológico repetido seis meses após o tratamento. O mesmo teste diagnóstico foi utilizado para avaliar a cura que foi definida como a ausência de ovos e cistos nas fezes. Das crianças estudadas, 79 (82,3%) estavam infectadas com um ou mais parasitas, os mais prevalentes foram *Ascaris lumbricoides*, *Trichuris trichiura* e *Giardia lamblia*. Os antiparasitários mais utilizados foram mebendazol (86% das prescrições) e metronidazol (30,3%) de acordo com a prevalência da infecção. A porcentagem de cura das 79 crianças estudadas após 6 meses do tratamento foi 65,3% para *A. lumbricoides* e 66,1% para *T. trichiura*. Este estudo sugere que um programa de educação continuada voltado para a prevenção e tratamento das infecções parasitárias tem se mostrado uma ferramenta útil na erradicação destas patologias.

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