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Epidemiological Study of Intestinal Parasitosis at the Albert Royer National Children's Hospital

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Abstract

Intestinal parasites are very common and represent a public health problem worldwide. Despite all the mass drug distribution strategies, these diseases still pose a public health problem in Senegal. It is in this context that we conducted this study, the aim of which was to reassess the epidemiology of intestinal parasitosis in children aged 0 to 15 years over one year in the parasitology-mycology laboratory of the Albert Royer Children's Hospital. The study involved 1426 children aged between 2 months and 15 years, with an average age of 5.15 years. Children under 5 years of age represented 52.59% of the study population, and those over 5 years of age were 47.41%, with a sex ratio of 1.5. There were 176 subjects carrying at least one parasitic species, giving an overall prevalence of 12.34%. Of the children with parasites, 76.14% had intestinal protozoosis and 23.86% had helminthiasis. The parasitic species isolated were represented by *Entamoeba coli* (51.70%), followed by *Giardia lamblia* (17.05%), *Entamoeba histolytica* (5.11%), *Trichomonas intestinalis* (1.14%) and *Entamoeba histolytica* (0.57%). The main helminths found were eggs of *Ascaris lumbricoides* (21.02%) followed by *Ankylostoma duodenale* (1.14%), *Trichuris trichiura* (1.14%) and *Taenia sp.* (0.57%). The results of our study show once again the endemic nature of the disease.

Keywords

Protozoosis, Helminthiasis, Children, Drug Administration, Hospital

1. Context

Intestinal parasitosis is a condition caused by the presence of helminths and/or parasitic protozoa in the intestine. According to the WHO, there are more than

1.5 billion people, 1.5 billion infected people or 24% of the world's population. These infections are responsible for 155,000 deaths each year. In 2020, chemoprevention for geo-helminthiasis was needed in 87 countries [1] [2].

Many species of parasites belonging to different classes can colonize the human digestive tract and school-age children constitute a very exposed population. Several studies have shown the high prevalence of intestinal parasitosis in this category of the population [1]-[3]. Previous studies carried out in Senegal have shown variable prevalences of intestinal parasitosis of up to 35% in rural areas and 20% in urban areas [3]-[5]. This variation may be due to various factors (environmental, socio-economic, lifestyle, etc.). The results of baseline surveys carried out in 2013 at national level revealed a prevalence of intestinal parasitic infections of 21.9%. Ascaris lombricoides was the main cause of parasitic infection, accounting for 46.7% of cases observed [6].

Geohelminths are transmitted by eggs excreted in the faeces of infested people. Adult worms live in the intestines, where they lay thousands of eggs every day. In places where sanitation facilities are inadequate, these eggs contaminate the soil and are passed on to humans through dirty hands, contaminated water, etc [1].

The pathogenicity of these parasites is variable, ranging from simple asymptomatic carriage to extremely serious or even fatal symptomatic pictures. Although the symptoms often go unnoticed, these parasites aggravate the problem of malnutrition and anemia, which stunt growth and make the child vulnerable to other diseases and influence school performance [7] [8].

To combat this problem, the World Health Organization has recommended since 2001 to deworm children under 5 years of age. Thus, Senegal, through the Ministry of Health and Social Action, has been implementing deworming campaigns with mebendazole (later replaced by albendazole) since 2006 [1] [4]. In Senegal, satisfactory therapeutic coverage of mass drug distribution was noted between 2015 and 2019, ranging from 87% to 100%. During these five years (2015-2019), the geographical coverage of mass drug distribution was 100%, with the exception of 2019 when it was 50%, probably due to the Covid-19 pandemic. This strategy for preschool and school-age children has significantly reduced the frequency of intestinal parasitosis in this target group, with a reduction in morbidity of more than 81% 4 - 6 [6].

This one-year retrospective study (2018-2019) aims to re-evaluate the epidemiology of intestinal parasitosis in paediatric hospitals after several years of mass treatment and analyze their socio-demographic and biological characteristics (age, sex, gross and microscopic examination of stool).

2. Materials and Method

2.1. Study Design and Population

We conducted a retrospective study at the parasitology and mycology laboratory of Albert Royer National Children's Hospital (CHNEAR). The population was represented by all patients who underwent parasitological stool examination at

the laboratory.

2.2. Data Collection

Data were collected on an individual card from clinical records, consultation records and the bench. The main variables studied were age, sex, clinical examination, microbial flora, presence of red blood cells, leukocytes, yeasts, and parasitological results. Patients with less than 70% completeness of variables studied were excluded.

2.3. Parasitological Examination

A sterile container has been given to the patient who is coming to the laboratory for stool collection. Macroscopic examination was first done to note the color and consistency of the stools as well as the possible presence of blood, debris, and mucus, in addition to detecting certain parasites in the adult form, such as tapeworm rings, roundworms, etc.

Microscopic examination of the stool was then carried out, including examination of fresh stool, examination of stool after staining with lugol, and the Ritchie concentration technique to detect the various parasitic forms (cysts, vegetative forms, eggs, larvae) and non-parasitic elements.

2.4. Statistical Analysis

Our data was entered into Excel and analyzed using Epi info version 7.2.2.2. Quantitative variables were described in terms of means. Inter-group comparisons were made using test of *Student* or ANNOVA after verification of the conditions of application of these tests. When the conditions were not respected, non-parametric tests were chosen. (Manwhitney, Kruskall Wallis)

The qualitative variables were described in terms of numbers and percentages of data provided. The significance threshold of statistical tests was set at 5.

3. Results

3.1. Socio-Demographic Characteristics

Table 1. Socio-demographic characteristics.

Parameters	Frequency	Percentage	CI (95%)
Age category			
Under 5 years old	750	52.59%	50.00% - 55.18%
More than 5 years	676	47.41%	44.82% - 50.00%
Sex			
Female	571	40.04%	37.53% - 42.61%
Male	855	59.96%	57.39% - 62.47%

Table 1 shows that 1426 children were included in our study. The children's ages

ranged from 2 months to 15 years, with an average of 5.15 years. The age distribution showed that the study population consisted mainly of children under 5 years, with several 750 or 52.59%. Children aged 5 and over accounted for 47.41%. Our study population consisted mainly of male subjects (59.96%) with a sex ratio of 1.50.

Most of the parasitological examinations were requested as part of an assessment with 34.11%. The other indications were mainly represented by abdominal pain 15.93%, vomiting 13.88%, fever 11.49%, diarrhoea 11.42% and acute gastroenteritis 9.87%.

3.2. Results of the Macroscopic Examination

The results of our study showed that most of the patients included in the study had stools with a paste-like consistency (64.75%), followed by those with molded stools (17.98%), mucous (12.30%), and finally fluid (4.98%). Regarding coloration, 74.69% of the stools were brown, followed by yellow with 15.17%, green with 6.59%, black with 3.40%, and red with 0.15%. (Table 2)

Table 2. Macroscopic examination results.

Parameters	Number	Frequency	CI (95%)
Consistency			
Pasty	911	64.75%	62.21% - 67.20%
Molded	253	17.98%	16.06% - 20.07%
Liquid	70	4.98%	3.96% - 6.24%
Slime	173	12.30%	10.68% - 14.11%
Colour			
Brown	1009	74.69%	72.30% - 76.93%
Yellow	205	15.17%	13.36% - 17.19%
Black	46	3.40%	2.56% - 4.51%
Red	2	0.15%	0.04% - 0.54%
Green	89	6.59%	5.38% - 8.04%

3.3. Microscopic Examination Results

Of the patients included in our study, 49.72% had an average microbial flora, 40.20% abundant, and 10.08% poor. Red blood cells, leukocytes, and yeasts were present in 8.44%, 17.51%, and 27.79% of the stool samples, respectively. (Table 3)

Table 3. Microscopic examination results (Non-Parasitic Elements).

Parameters	Number	Frequency	CI (95%)
Flora			
Poor	143	10.08%	8.62% - 11.76%
Average	705	49.72%	47.12% - 52.32%
Abundant	570	40.20%	37.68% - 42.77%

Continued

Red blood cell			
Absence	1302	91.55%	89.07% - 95.17%
Presence	120	8.44%	6.84% - 11.07%
Leukocytes			
Absence	1173	82.49%	79.90% - 86.26%
Presence	249	17.51%	15.15% - 20.86%
Yeast			
Absence	1029	72.21%	69.29% - 76.36%
Presence	396	27.79%	24.96% - 31.82%

3.4. Prevalence and Distribution of Intestinal Parasitosis

The result of parasitological stool examinations was positive in 12.34%, *i.e.*, 176 parasitized subjects out of a total of 1426 children. Different species of parasites were encountered with a predominance of protozoa 76.14% in our positive samples while helminths represented 23.86%. *Entamoeba coli* cysts were more represented at 51.70%, followed by *Giardia lamblia* cysts 17.05%, *Entamoeba histolytical dispar* cysts 5.11%, *Trichomonas intestinalis* 1.70% and finally 0.57% of the vegetative form *Entamoeba histolytica*. The main helminths found were: *Ascaris lumbricoides* (21.02%), *Ankylostoma duodenale* (1.14%), *Trichiuris trichiura* (1.14%), and *Taenia sp.* (0.57%). We found no co-infection among the parasitized subjects. (Table 4)

Table 4. Prevalence and distribution of intestinal parasitosis.

Parameters	Number	Frequency
Prevalence		
Positive	176	12.34
Negative	1256	87.66
Parasite		
Protozoans	134	76.14
Helminths	42	23.86
Cash		
Entamoeba coli cysts	91	51.70
Entamoeba *histolytica cysts*	9	5.11
Entamoeba histolytica vegetative form	1	0.57
Giardia lamblia cyst	30	17.05
Trichomonas intestinalis vegetative form	3	1.70
Ascaris lumbricoides	37	21.02
Ankylostoma duodenale	2	1.14
Trichiuris trichiura	2	1.14
Taenia sp.	1	0.57

3.5. Prevalence of Intestinal Parasitosis by Socio-Demographic and Clinical Factors

Table 5 shows that intestinal parasitism was more frequent in children over 5 years of age (53.98%), with no statistical difference (p-value = 0.1). The male sex was mostly affected with 57.95% against 42.05%.

Depending on the indication, our results showed that the prevalence of intestinal parasitosis was highest in patients presenting for assessment (36.36%), followed by patients presenting with diarrhoea (17.04%). This was followed by patients presenting with abdominal pain (17.04%), vomiting (13.64%), diarrhoea (11.93%), fever (10.23%), gastroenteritis (7.39%), chronic cough (1.70%) or weight loss (0.57%). No statistical difference was found (p-value = 0.9).

Table 5. Prevalence of intestinal parasitosis by socio-demographic and clinical factors.

Parameters	Number	Frequency	CI (95%)
Age Category			**P value** = 0.1
Under 5 years old	81	46.2	37.40 - 52.55
More than 5 years	95	53.98	47.45 - 62.6
Sex			**P value = 0.5**
Female	74	42.05	34.66 - 49.70
Male	102	57.95	50.30 - 65.34
Clinical indication			**P value = 0.9**
Abdominal pain	30	17.04	11.88 - 23.56
Acute gastroenteritis	13	7.39	3.18 - 10.97
Chronic cough	3	1.70	0.63 - 5.75
Balance sheet	64	36.36	29.43 - 44.17
Diarrhoea	21	11.93	5.76 - 15.10
Vomiting	24	13.64	8.99 - 19.72
Weight loss	1	0.57	0.01 - 3.14
Fever	18	10.23	6.21 - 15.77
NR	2	1.14	0.14 - 4.07

3.6. Prevalence of Intestinal Parasitosis According to the Macroscopic Appearance of the Stool

In our study, patients with a paste-like stool consistency had more intestinal parasitosis (67.05%), followed by those with molded, mucous, fluid stools with no statistical difference (p value = 0.4).

The color of the stool was statistically related to the presence of the parasite. (p value = 0.04). The majority of parasitized patients also had brown stools (80.81%), followed by children whose stools were yellow 11.05%, black 4.07%, green 2.91% and red 1.16%. (Table 6)

Table 6. Prevalence of intestinal parasitosis according to the macroscopic appearance of the stool.

Parameters	Frequency	Percentage	CI (95%)
Consistency			**P value = 0.4**
Pasty	116	67.05%	59.51 - 74.00
Molded	34	19.65%	13.51 - 25.73
Liquid	8	4.62%	2.02 - 8.91
Slime	15	8.68%	4.93 - 13.90
Colour			**P value = 0.04**
Brown	139	80.81%	71.59 - 84.38
Yellow	19	11.05%	6.78 - 16.71
Black	7	4.07%	0.95 - 6.65
Red	2	1.16%	0.14 - 4.14
Green	5	2.91%	0.95 - 6.65

3.7. Prevalence of Intestinal Parasitosis According to Microscopic Examination

We noticed that among the parasitized subjects, 5.58% had red blood cells in their stool, but they were absent in 94.32% of the parasitized patients.

The results of our study show that 12.57% of the parasitized patients had leukocytes in their stool compared to 87.43% where they were absent.

During our study, we noted that among the parasitized subjects, 21.72% had yeast in their stools compared to 78.28%. Among the parasitized patients, 52% had a medium flora, followed by patients with abundant flora 39.43 and 8.57% with poor flora. (Table 7)

Table 7. Prevalence of intestinal parasitosis by microscopic examination.

Parameters	Number	Frequency	CI (95%)
Red blood cell			**P value = 0.1**
Presence	10	5.58	2.76 - 10.20
Absence	166	94.32	87.70 - 96.01
Leukocyte			**P value = 0.7**
Presence	22	12.57	6.21 - 15.77
Absence	154	87.43	80.28 - 91.01
Yeast			**P value = 0.02**
Presence	38	21.72	15.34 - 27.95
Absence	137	78.28	70.82 - 83.65
Flora			**P value = 0.7**
Poor	15	8.57%	4.88 - 13.74
Average	91	52%	44.33 - 59.60
Abundant	69	39.43%	32.14 - 47.08

4. Discussion

Intestinal parasites are very common and represent a public health problem on a global scale. Their prevalence is very high in Third World countries, where environmental and social characteristics favour their development and are factors in the perpetuation of these infections. Senegal's objective is to eliminate geohelminthiasis by 2030. The strategies implemented to achieve this goal are: availability of Albendazole or Mebendazole, organisation of mass drug distribution campaigns (therapeutic coverage ≥ 75% of children aged 5 to 14 in all endemic districts), case management, promotion of hygiene and sanitation measures, awareness-raising and organisation of impact surveys.

As part of the WHO initiative to combat neglected tropical diseases, Senegal's Ministry of Health and Social Action launched a mass deworming programme for children several years ago to combat intestinal parasitosis in this vulnerable segment of the population.

Our study aims to provide the most recent data on the situation of intestinal parasitosis in children in Senegal after several years of mass treatment.

A prevalence of 12.34% was found, and different types of parasites were isolated during our work, with a predominance of protozoa (76.14%) compared to helminths 23.86%. Similar results were observed by Lélo *et al.* in Dakar suburbs in 2019. Sylla *et al.*, in 2013, found a higher prevalence of 35% in rural areas [3] [9]. In various studies carried out in Senegal, the same epidemiological profile as ours has been found, particularly in the predominance of protozoa. Lélo *et al.* found that 44.73% of the parasites found in his study were protozoa and for Sylla *et al.* 93.4%. This is probably due to the improved sensitivity of mebendazole to helminths, which is used in mass treatment campaigns.

In the subregion, other authors had also reported high prevalences of intestinal parasitosis. This is the case of Cisse *et al.* in Burkina Faso, who reported a prevalence of 54.7% in a retrospective study from 1997 to 2007 [10].

A study carried out in Côte d'Ivoire by Yapi *et al.* in 2005, showed a prevalence of 68.2% of intestinal parasitosis with a predominance of protozoa over helminths [11]. A study conducted by Buzigi *et al.* in Uganda, in 2014, showed a prevalence of intestinal parasitosis of 54.4%, *Giardia intestinalis* was the most common parasite followed by *Entamoeba histolytica* while helminths were poorly represented [12].

Intestinal parasitism in children over 5 years of age was higher (53.98%) compared to children under 5 years of age (46.02%). Contradictory results have been reported in Senegal by Tine *et al.* in 2013, indicating a predominance of protozoa in children under 5 years of age [13].

Male children were the most affected (57.95%). Lélo *et al.* in Dakar and Chaudhry Zh *et al.* in Pakistan reported similar results (22.7% and 31.6%, respectively) [8] [14]. However, the study conducted by Sylla *et al.* in a rural area in the commune of Keur Socé in Senegal showed a higher prevalence in female subjects than in males, although without any significant difference [3].

The consistency, presence of red blood cells, leukocytes, yeasts, and clinical indication do not seem to be decisive for the presence of parasites in the stool (p-value higher than 0.05).

Regarding the frequency of parasites according to stool consistency, our results confirm the data from Aplogan A *et al.* which show that no parasite seems to be directly and exclusively responsible for the appearance of stool in children. [15].

5. Conclusion

The results of our study show once again the endemic nature of intestinal parasitosis in Senegal, with a non-negligible hospital prevalence at the Albert Royer Children's Hospital dominated by protozoa in all age categories. The lower rate of infestation among children under 5 years of age is probably the result of the action of the Ministry of Health and Social Action. Hence, there is a need to continue the mass administration of Albendazole coupled with vitamin A in children aged 6 months to 59 months to fight against fecal perils and to promote health education for behavioral change.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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