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Prevalence of Intestinal Parasites in Schoolchildren in 4 Departments of the Republic of Congo

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Abstract **Introduction:** Intestinal parasitosis is a neglected tropical disease and a public health problem in developing countries. **Objectives:** The aim of this study, conducted in a school setting, was to determine the prevalence of intestinal parasites in school children. **Patients, materials and method:** The study consisted of analysing 377 stools from children aged 5 to 14 years. Each stool sample underwent a parasitological stool examination including macroscopic stool examination and microscopic examination before and after the simplified Ritchie enrichment technique. **Results:** The prevalence of intestinal parasites was 24.4%. According to age group, children aged 5 to 7 years had the most parasites. The sex ratio (M/F) was 0.83 in favour of girls. The frequency of intestinal parasitosis according to the type of parasite was 21.6% for helminths and 78.4% for protozoan parasites. Monoparasitism occurred in 81.4% (79 cases), biparasitism in 16.5% (16 cases) and triparasitism in 2.1% (2 cases). The intestinal parasites identified were: *Entamoeba coli* (53.6%), *Ascaris lumbricoides* (12.4%), *Endolimax nana* (11.3%), *Giardia intestinalis* (7.2%), *Entamoeba hartmanni* (9.3%), *Iodamoeba bütschlii* (5.2%), *Entamoeba histolytica* (6.2%), *Entamoeba polecki* (2.1%), *Entamoeba dispar* (4.2%), *Trichuris trichiura* (6.2%) and S*trongyloides stercoralis* (3.1%). **Conclusion:** Intestinal parasitosis remains a public health problem in schoolchildren. Protozoan parasites are more common than helminths. The most common parasites are *Entamoeba coli*, *Ascaris lumbricoides* and *Endolimax nana*.

Keywords: *Parasites, Intestinal parasitic infections, Schoolchildren, Congo*

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1. Introduction

Intestinal parasitosis is the colonisation of the digestive tract by parasites. Various parasitic species colonise the human digestive tract, including protozoa and helminths, which are most often found in the intestine [1]. Parasites whose pathogenic role justifies the diagnostic and therapeutic management of induced pathologies must not be neglected because of their prognosis [2].

In 2002, the World Health Organisation (WHO) estimated that 3.5 billion people were infested with digestive parasites and 450 million were ill. Of these, more than 270 million pre-school children and 600 million school-age children live in regions where the transmission of these parasites is intensive. Every year, roundworms, hookworms and amoebae cause an estimated 195,000 deaths worldwide. These intestinal parasites are rife in all tropical and subtropical regions, particularly in sub-Saharan Africa, South America, China and East Asia [2,3,4,5,6]. Intestinal parasitosis mainly affects children and is responsible for anorexia, malabsorption and, secondarily, undernutrition, and over-consumption of antiparasitic drugs [2,7]. They are favoured by ignorance of food and environmental hygiene, and frequent contact with the ground. The clinical picture may seem noisy or frustrating, but early diagnosis is now easy thanks to the performance of direct stool analysis and serology methods [8,9].

In Africa, a number of studies have been carried out on intestinal parasitosis in school-age children, notably in Morocco, Ethiopia, Senegal, Côte d'Ivoire and the Democratic Republic of Congo, with prevalence rates of 57.1%, 66.7%, 31.3%, 36.46% and 37.7% respectively.

31.3%, 36.46% and 60% respectively [2,10,11,12,13].

In the Congo, intestinal parasitosis suffers from a lack of attention, insufficient and out-of-date factual data, and

insufficient scientific publications. Geo-helminthiasis is present in every department of the Congo, with prevalence rates ranging from 20 to 80%, according to a comprehensive mapping exercise carried out in 2011, integrated with that of schistosomiasis. The populations most affected are pre-school and school-age children. Data from the 2015 statistical yearbook show that the departments most affected are Brazzaville (11,661 cases), Sangha (2,877 cases) and Pool (2,398 cases) [9].

Nevertheless, despite the fragmentary nature of these studies, a few can be highlighted. According to Atanda et al, trichocephalosis was the most common helminthiasis in urban areas, with a prevalence of 54.56% [14]. On the other hand, for Richard et al, intestinal parasitosis represented 26.6% of the main reasons for consultation among school-age children and 17.9% among children aged 2 to 5 years [15]. Another study by Boukaka showed a prevalence of intestinal parasitosis of 30.6% among school-age children hospitalised at the Brazzaville University Hospital Center [16].

The general aim of this study is to determine the prevalence of intestinal parasites in schoolchildren in the Congo.

2. Patients, Materials and Method

This was a descriptive cross-sectional study that took place from May 1 to October 31, 2021 in elementary school across the country, particularly in urban areas (Brazzaville and Pointe Noire) and rural areas (Nkayi and Oyo). It involved children aged 5 to 14 attending elementary school in the study localities, living there for more than 3 months, who had given their consent, and for whom parental and/or teacher authorization had also been obtained. For each child, a fresh stool sample was taken. The samples were analyzed in the laboratories of the health centers in the various localities (laboratory of the Centre hospitalier universitaire de Brazzaville for, laboratory of the Hôpital général Adolphe Cissé for Pointe noire, laboratory of the Hôpital de base de Nkayi for Nkayi and the laboratory of the Hôpital général Edith Lucie Bongo Ondimba d'Oyo for Oyo). A parasitological examination of stools combining the simplified Ritchie concentration technique and lugol staining was carried out for each stool sample.

One public school per arrondissement was selected in each of the departments surveyed. The schools with the highest pupil numbers were selected. These were 9 schools in the 9 arrondissements of Brazzaville, 6 schools in the 6 arrondissements of Pointe Noire, 1 school in Nkayi and 1 school in Oyo.

Using data from the 2007 general population census, and a prevalence of intestinal parasitosis of 41.9% [17], the sample size was estimated at 374.

Variables of interest were related to children's socio-demographic and school characteristics, parasite species and type of parasitism.

Data entry and analysis were performed using SPSS 25 software. Qualitative variables were presented as numbers and proportions, and quantitative variables as means with standard deviation and/or median.

Ethical aspects

Ethical clearance was obtained from the Comité d'Ethique et de la Recherche en Sciences de la Santé under number 372/MESRSIT/IRSSA-CERSSA. The Ministry of Primary, Secondary and Literacy Education and the Faculty of Health Sciences issued research authorizations.

3. Results

3.1. Frequency of Intestinal Parasites

Out of 377 samples analysed, 71 samples (18.8%) were positive before concentration compared with 92 (24.4%) after concentration.

3.2. Socio-demographic Characteristics of Children with Parasites

Table 1 shows the distribution of parasitized children in the 2 study localities. The sex ratio was in favour of girls. The age group most affected by intestinal parasites was 5-10 years, with a frequency of 59.8%. The urban area was the one where intestinal parasites were found most frequently (84.5%).

Table 1. Socio-demographic characteristics of children with parasites in the 4 départements

Variables	Number (N)	Percentage (%)
Sexe		
Male	44	45.4
Female	53	54.6
Sex ratio	0,83	
Ages range		
5 – 10	58	58.8
11 – 14	39	40.2
Educational level		
CP1	17	17.5
CP2	21	21,6
CE1	17	17.5
CE2	11	11.3
CM1	15	15.5
CM2	16	16.5
Localities		
Urban area	82	84.5
Rural area	15	15.5

3.3. Types of Parasites Listed

The overall frequency of intestinal parasitosis according to the type of parasite was 21.6% (21 cases) for helminthiasis and 78.4% (76 cases) for protozoosis.

Before concentration, the frequency of helminthiasis was 15.5% (11 cases) compared with 84.5% (60 cases) for protozoosis. After concentration, it was 22.8% (21 cases) for helminthiasis compared with 77.2% (71 cases) for protozoosis.

In each department, the frequencies of helminths and protozoan parasites were respectively 3.6% (2 cases) vs 96.4% (53 cases) for Brazzaville; 29.6% (8 cases) vs 70.4% (19 cases) for Pointe-Noire; 60.0% (6 cases) vs 40.0% (4 cases) for Oyo (cuvette); and 100.0% (5 cases) vs 0.0% for Nkayi (Bouenza) (p=0,000).

3.4. Type of Parasitism

The type of parasitism found was monoparasitism in 79 stools (81.4%), biparasitism in 16 stools (16.5%) and triparasitism in 2 stools (2.1%).

For each department, the frequencies of monoparasitism, biparasitism and triparasitism were 72.7% (40 cases), 23.6% (13 cases) and 3.6% (2 cases) respectively for Brazzaville; 96.3% (26 cases), 3.7% (1 case) and 0.0% for Pointe-Noire; 80.0% (8 cases), 20.0% (2 cases) and 0.0% for Oyo (Cuvette); then 100.0% (5 cases), 0.0% and 0.0% for Nkayi (Bouenza) (p=0,162).

3.5. Parasitic Species Identified

The parasite species identified during the study are shown in Figure 1. The most commonly isolated parasite was *E. coli* (53.6%), followed by *A. lumbricoides* (12.4%) and *E. nana* (11.3%). *E. histolytica* was found in 6.2% of the examined children.

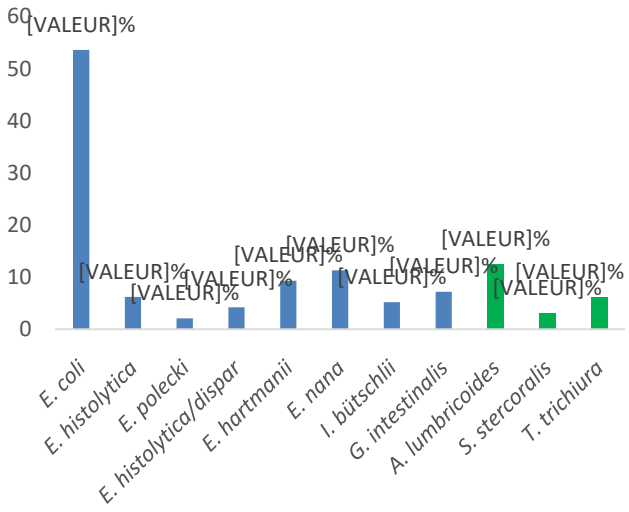

Figure 1. Parasitic species identified in the faeces of children with parasites during the period from 1 May to 31 October 2021

4. Discussion

Analysis of the methodology

The methodology used did not make it possible to assess the existence of complications or the reduction in the frequency of parasitosis following the administration of antihelminthics. In addition, the lack of funding meant that this important aspect of the study could not be carried out.

The diversity of the sample analysis centres may have introduced a bias due to the varied skills of the technicians who were involved in reading the samples. It would have been appropriate for the samples to have been read by the same team in all the departments.

Finally, the distance of the schools from the health centres, in the majority of cases, may have been the reason for the low frequency of observation of the vegetative forms of the parasites. Sometimes, because of the state of the roads and traffic jams, the journey from the sampling site to the laboratory could take more than an hour.

Protozoan diseases and helminthiasis

Our study reported 84.5% of protozoa and 15.5% of helminthiasis. These results are similar to those found in a study in Niamey which reported 86.4% of protozoa and 13.6% of helminths [19], in the Maghreb, Benouis et al. in Algeria, reported 95.7% of protozoa and 4.3% of helminths [6], in the Sfax region in Tunisia 96.5% for protozoa and 3.5% for helminths [20], Tagajdid in Morocco noted a prevalence of protozoa of 57.7% [5] in Mauritania with Cheik Baba a prevalence of 31% for protozoa and 2% for helminths [21]. Still in Africa, particularly in Niger, Ba O's study showed that the prevalence of protozoan infections was also higher than helminthiasis [22]. Wakid MHM in Jeddah reported similar results [23]. On the other hand, in Guadeloupe, 72.3% helminths and 27.7% protozoa were reported [24].

Our observations are in line with the literature, which shows that intestinal protozoa predominate in most developing countries. These parasitic species are transmitted in cystic form, mainly via poorly washed raw foods (fruit, vegetables, salads) and water drawn from rivers polluted by human excreta and consumed without prior treatment. The majority of people drink tap water, and this is compounded by poor personal hygiene and climatic conditions that are conducive to the development of these parasites [25]. In our country, this observation has important therapeutic implications. Indeed, for many prescribers, a suspicion of intestinal parasitosis implies the use of an antihelminthic as the only treatment. In addition, deworming programmes in schools have been provided for Congolese children as a result of Congo's public health policy, which recommends about four systematic deworming sessions per year with antihelminthic drugs.

Parasitic species

The parasite species frequently found after the concentration technique were *Entamoeba coli* (53.6%), *Ascaris lumbricoides* (12,4%) and *Endolimax nana* (11.3%). Adou-Bryn in Côte d'Ivoire, *Entamoeba coli* (22.4%), *Trichuris trichiura* (9.5%) and *Endolimax nana* (4.8%) [26], and Cheick Baba in Mauritania, *Entamoeba coli* (14%), *Giardia intestinalis* (9%) and *Entamoeba histolytica* (3.75%) [21]. The predominance of *E. coli* was also found by Ba O in Nouakchott, followed by *G. intestinalis* and *E. nana* [22]. Like us, the high frequency of *Entamoeba* was found by these authors. Unlike Diouf in Senegal, *Ascaris lumbricoides* (18%), *Trichuris trichiura* (3.74%) and *Entamoeba coli* (2.67%) [27] and Ihejirika in Nigeria who found *Entamoeba histolytica* (5.3%), *Ascaris lumbricoides* (4.0%) and (52.7%) *Giardia lamblia* and *Entamoeba coli* [28]. However, unlike Diouf and Ihejirika, as well as Gupta in Nepal, Forson in Ghana and Zemene in Ethiopia, *Giardia* was the most common species found [29, 30, 31].

On the other hand, other authors have reported *Giardia intestinalis* as the leading intestinal parasitosis; this is the case for *Giardia* (15.4%), *Entamoeba histolytica* (7.7%) and *Entamoeba coli* (7.0%) [29]; with (28%) *Giardia* followed by *Schistosoma mansoni* (4%) and *Ascaris lumbricoides* (3%) [30]; Zemene in Ethiopia with (21%) *Giardia*, (14%) *Entamoeba histolytica* and (4%) *Trichuris trichura* [31]. In Saudi Arabia, Wakid MHM in Jeddah found *Blastocystis spp*, *G. lamblia* and *E. histolytica* [23].

This difference can be explained by methodological

reasons, in particular the stool concentration technique, which was different from ours (Ritchie's method), as other authors had used PCR tests and Kato's method.

Type of parasitism

Parasite species associations were observed in our study, which may or may not have been of the same parasite class. In our study, monoparasitism represented 81.4%, biparasitism 16.5% and triparasitism 2.1% overall.

In Brazzaville, single-parasitism predominated (71.7%), followed by two-parasitism (24.5%) and three-parasitism (3.8%). The same trend was observed in Pointe-Noire, with single-parasitism at 96.6% and two-parasitism at 3.4%.

In rural areas, particularly Nkayi and Oyo, the trends were different. In Nkayi, all the children were single parents; in Oyo, 80% were single parents and 20% double parents. By comparing the two areas, we can deduce that polyparasitism was higher in urban areas than in rural areas. This could be explained by the critical mass and concentration of the population, including children, being greater in urban areas, and the organisation and regularity of the deworming programme being more respected in rural areas. Almost all the children included in the departments of Oyo and Nkayi had benefited from school deworming at the start of the year, which was not the case in Brazzaville and Pointe-Noire due to weaknesses in the deworming programme in place. Similar results to ours were reported in Jeddah by Al-Refai MF [32]. In a study conducted in Algeria in children under 5 years of age, monoparasitism (84.6%) and polyparasitism in (15.4%) [6]. The same trend has been found in numerous African studies, notably in Morocco in the towns of Tiflet and Salé, where studies of schoolchildren reported 24.7% biparasitism and 4.1% polyparasitism respectively [10]; and 36.6% of polyparasitism [5]; in Ethiopia by Gadisa, monoparasitism (76.9%) and polyparasitism (23.1%) [33] and in the Central African Republic, monoparasitism (52.94%), biparasitism (31.37%) and triparasitism (1.96%) were found by Tekpa [34].

In Nouakchott, Ba O. also found a predominance of monoparasitism over polyparasitism. They also highlighted a low frequency of quadriparasitism [22]. Contrary to other studies, which reported a predominance of polyparasitism, notably in Colombia Hernandez with polyparasitism at 82.47% for monoparasitism (17.53%) [35]; in Mexico, Panty-May revealed polyparasitism (21%) and monoparasitism (9%) [36].

5. Conclusion

The Prevalence of intestinal parasitosis was higher in cases of protozoosis than helminthiasis in our context, indicating that intestinal parasites are still a major public health problem. The most common parasites were *Entamoeba coli*, followed by *Ascaris lumbricoides* and *Endolimax nana*. Polyparasitism is predominant in the departments of Brazzaville and Pointe Noire. It is therefore important to step up the fight against intestinal parasitosis in order to reduce its morbidity and its impact on social and health policies.

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