International Scholars Journals

African Journal of Parasitology Research ISSN 2756-3391 Vol. 9 (1), pp. 001-007, October, 2024. Available online at www.internationalscholarsjournals.com © International Scholars Journals

Research

Intestinal parasitosis: Prevalence and risk factors in schoolchildren in the post-COVID-19 period in 2021 in 4 departments of the Republic of Congo

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Received: 13-March-2024, Manuscript No. AJPROAJ-24-149035; Editor assigned: 18-March-2024, PreQC No. AJPROAJ-24-149035 (PQ); Reviewed: 01-April-2024, QC No. AJPROAJ-24-149035; Revised: 05-September-2024, Manuscript No. AJPROAJ-24-149035 (R); Published: 03-October-2024

Introduction: Intestinal parasitosis are colonizations of the digestive tract by parasites, helminths or protozoa, representing a public health problem in developing countries. The factors involved in their occurrence are varied.
Objective: The aim of this study was to investigate the prevalence and risk factors associated with their occurrence in the Republic of Congo.
Patients, materials and method: This was a cross-sectional, descriptive study conducted over a six-month period from May 1 to October 31, 2021, in elementary school and laboratories in health facilities in 4 departments of the Republic of Congo. Parasitological examination of stools combined with a stool concentration technique was used to search for parasites. Data were entered and analyzed using SPSS version 20 software. The threshold of statistical significance was set at p<0.05.
Results: The sample size was 377 school-age children. 97 of the 377 samples were positive, representing a prevalence of 25.7%. The localities of Oyo and Nkayi were those where the prevalence of intestinal parasitosis was significantly higher (p=0.006), with 45.5% and 30.4% respectively. The sex ratio (M/F) was The localities of Pointe-noire and Nkayi were those where the risk of intestinal parasitosis was significantly highest, with p=0.041 and p=0.029 respectively. No risk factors for intestinal parasitosis related to socio-economic conditions and hygiene rules were associated with the occurrence of intestinal parasitosis.
Conclusion: Intestinal parasitosis remains a public health problem in our country. They are most prevalent in Pointe-noire and Nkayi. However, no risk factors have been identified in the post-Covid-19 period.

Keywords: Intestinal parasitosis, Risk factors, Schoolchildren, Department, Congo

INTRODUCTION

Intestinal parasitosis is the colonization of the digestive tract by parasites. These parasites may be helminths or protozoa. They constitute a health problem in developing countries, with socio-economic consequences of varying severity in vulnerable rural communities [1-3]. According to the World Health Organization (WHO), some 1.5 billion people suffer from intestinal parasitosis, with helminthiasis predominating. This prevalence exceeds 50% of the population in sub-Saharan Africa [4]. School-age children represent the population most affected by these parasitoses, with significant morbidity and mortality [5-7].

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Risk factors for intestinal parasitosis include low socio-economic status, poor personal and environmental hygiene, contaminated water consumption and poor stool management. The precariousness and impoverishment of populations, as well as the anarchic growth of megacities in developing countries. Family size, parents' level of education and employment are also factors influencing the occurrence of intestinal parasitosis [8,9]. A hot, humid climate is also a factor in the occurrence of these parasitoses in tropical and sub-tropical countries.

In the Republic of Congo, intestinal parasitosis suffers from a lack of attention, reflected in a shortage of scientific publications, despite the existence of a program to combat geohelminthiasis. In addition, the Congo's low socio-economic level, precarious hygiene conditions, climate and tropical location are all risk factors for intestinal parasitosis. Data from the 2015 demographic survey showed that intestinal parasitoses had a prevalence of 20% to 80% depending on the country's departments [10]. The populations most affected are preschool and school-age children, with a prevalence of 17.9% among preschoolers and 26.6% among school-age children [11]. However, few data are available on the risk factors for intestinal parasitosis in the country.

Thus, the aim of our work was to determine the prevalence of intestinal parasitoses and to investigate their risk factors in school-age children.

MATERIALS AND METHODS

This was a cross-sectional, descriptive study conducted over a six-month period from May 1 to October 31, 2021, in elementary school and laboratories in health facilities in 4 departments of the Republic of Congo (Brazzaville, Pointe-Noire, Nkayi and Cuvette). In Brazzaville, the study took place in one of the schools in each of the city's 9 arrondissements, where samples were collected. Samples were analyzed in the Parasitology-Mycology laboratory of the Centre Hospitalier Universitaire de Brazzaville. In Pointe-Noire, samples were collected from schools in each of the city's 6 districts. The Adolphe Cisse General Hospital laboratory. In Nkayi, samples were collected from schools in the city's 2 districts. The laboratory of the Nkayi referral hospital was used to analyze the samples collected. Finally, in the cuvette, the only elementary school in the town was the study site. The samples collected were analyzed in the laboratory of the Edith Lucie Bongo Ondimba general hospital in Oyo. The study involved school-age children attending public elementary school in the four departments of the Republic of Congo selected for the study. The selected school was chosen on the basis of the school with the highest number of children. We included children of both sexes aged between 5 and 14 years attending one of the public schools in the selected departments of the Republic of Congo at the time of the survey, after obtaining permission from the parents and/or teacher and those who brought back the stool sample. Not included in the study were children who had arrived less than three months previously in the department/district where the selected school was located, children whose parents or teacher had not consented to the study and children with an intercurrent pathology at the time of the study. Exclusion criteria were: any child who did not return the stool sample or whose stool sample was insufficient, any child whose parent subsequently objected to the child's participation in the study. The population sampled in this study consisted of all children aged 5 to 14 attending public elementary school in Brazzaville, Pointe-Noire, Nkayi and Oyo. As a statistical unit, these children were all eligible, based on data from the 2007 general population census.

The sample size calculated by the Schwartz formula was 374 stool samples, based on a prevalence of intestinal parasitosis in the Republic of Congo of 41.9% [12].

Sampling was 3-stage stratified probability sampling, in the absence of an exhaustive list of schoolchildren aged 5 to 14 in the various localities selected. The 2007 general population and housing census (RGPH) showed that Brazzaville had 1,373,382 inhabitants, Pointe-Noire 715,334 and the districts of Nkayi and Oyo had 71,623 and 17,948 inhabitants respectively (5=10 Institut National des Statistiques (INS) CONGO, perspectives demographiques), with an annual growth rate of 3%. Applying the following formula P2020=P2007 (1+0.03)14, the populations of these entities in 2020 were estimated at 2,077,364 for Brazzaville, 1,082,007 for Pointe-Noire, 108,336 for the Nkayi district and 27,148 for the Oyo district.

Table I shows the sample size by departure. The first stage involved dividing the overall sample into the four territorial entities (Brazzaville, Pointe-Noire, Nkayi and Oyo), each considered as a stratum made up of one or more districts or arrondissements. Thus, the Brazzaville stratum had nine districts, the Pointe-Noire stratum six and the Nkayi and Oyo strata one district each, for a total of 17 districts. The distribution of the overall sample across the four strata was weighted according to the number of arrondissements making up each stratum. The weighting coefficient was calculated according to the population size (or critical mass) of each arrondissement. This was estimated at: 52.9% for Brazzaville, 35.3% for Pointe-Noire, 5.9% for each of Nkayi and Oyo. The second stage consisted in distributing the sample from each stratum to the schools, one per arrondissement. The choice of school was made on the basis of the school inspectorate's enumeration ofthe relevant districts and according to the size of the critical mass of children enrolled. The school selected was based on the school with the highest number of children.

Based on the sampling type and procedure described above, the study sample was distributed as follows: in Brazzaville, the sample size was 216 children for 9 arrondissements, with 24 children per school; in Pointe-Noire, the sample size was 144 children for 6 arrondissements, with 24 children per school; in Nkayi, the sample size was 48 children for 2 districts; and in Oyo, the sample size was 24 children for one district and one school. A survey form was administered to the teachers and parents of the selected pupils. A stool sample was given to each child selected for the study for fresh stool collection. The stool samples obtained were analyzed in each laboratory using the modified Ritchie technique using 10% formalin, ether and centrifugation at 3000 rpm for 5 minutes, a drop of lugol and microscopic reading with x10 and x40 objectives before and after enrichment.

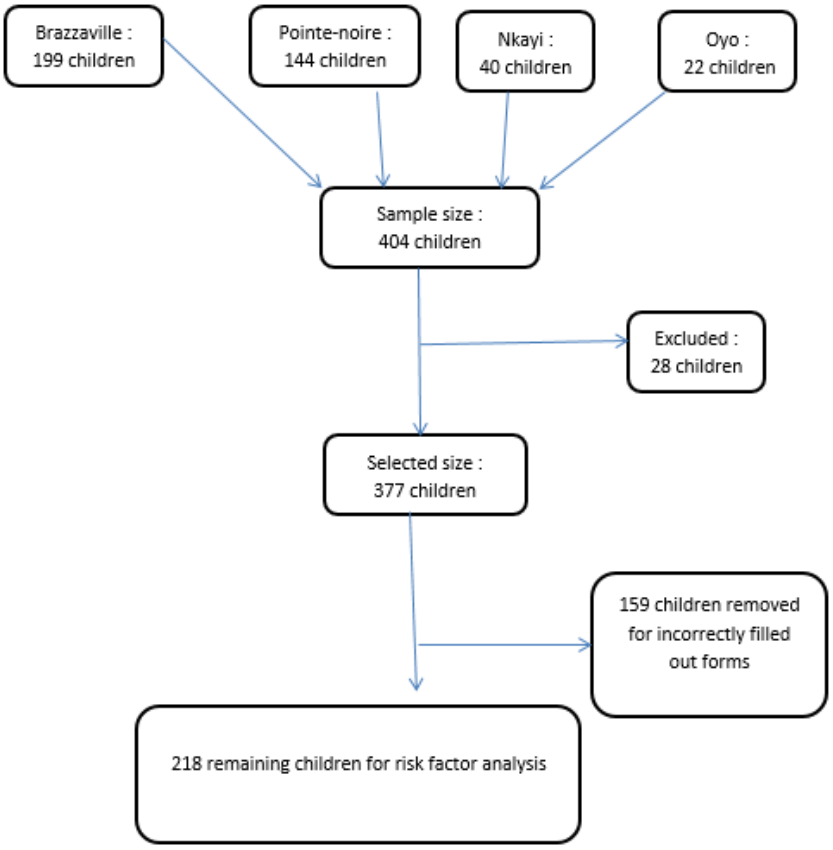
Stool samples were transported in a cool box at room temperature. The variables studied were the children's sociodemographic and school characteristics, frequency of pathology, Latrine type, communal latrines, hand-washing on leaving the toilet, food preservation, consumption of raw food, cleaning before consumption, consumption of street food, washing before meals.

Data were collected, entered and analyzed using SPSS 25 software. Qualitative variables were presented as numbers and proportions. Quantitative variables were presented as means with standard deviation and/or median. The significance level for statistical tests was $p<0.05$.

RESULTS

Our calculated sample was 374 children, we were able to collect a sample of 405 children distributed as follows as shown in Figure 1: 199 children in Brazzaville, 144 children in Pointe Noire, 40 children in Nkayi and 22 children in Oyo. 28 children were withdrawn due to incorrectly completed forms, parental refusal to continue the survey and insufficient stool samples for analysis, reducing our sample to 377 children. With regard to the analysis of risk factors and parental characteristics, 159 children were withdrawn for poor completion and inconsistency of responses between parental and child records. 218 parent records were matched with child records.

Figure 1. Data flow diagram explaining the intestinal parasitosis risk factor analysis process.



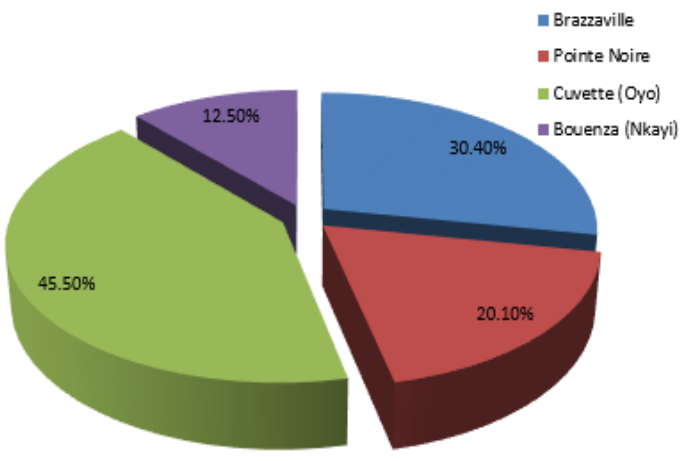
Overall prevalence of intestinal parasitosis in schoolchildren

377 samples were analyzed, of which 97 were positive, representing a prevalence of 25.7%.

Overall prevalence by department or locality

The prevalence of intestinal parasitosis by department or locality is shown in figure 2. The cuvette department had the highest prevalence (45,50%), followed by Brazzaville (30,40%).

Figure 2. Distribution of intestinal parasitosis by département risk factors for intestinal parasitosis in school-age children.



The localities associated with the occurrence of intestinal parasitosis were Pointe-Noire (p=0.041) and Nkayi (p=0.029), as shown in Table I. Other factors were not associated with the occurrence of intestinal parasitosis. No age group was found to be more at risk of intestinal parasitosis than others. Neither socio-economic level nor household size was associated with the occurrence of intestinal parasitosis.

Table II shows that there are no risk factors for intestinal parasitosis in the study population. Some factors known to be associated with the occurrence of intestinal parasitosis were not associated with the occurrence of parasitosis in the school-age children in our study (p>0.05).

Table 1. Factors related to socio-demographic characteristics, household type, household size and socio-economic level of parasitized children.

Variables	Intestinal parasitosis				OR (IC95%)	p-value
	Positive		Negative			
	Number (N)	Percentage (%)	Number (N)	Percentage (%)		
Gender						
Male	44	24.3	137	75.7		
Female	53	27.0	143	73.0	0.87 (0.55-1.38)	0.544
Age range						
5-7	22	31.0	49	69.0	1	
8-10	36	22.5	124	77.5	0.65 (0.35-1.21)	0.170
11-14	39	26.7	107	73.3	0.81 (0.44-1.51)	0.511
Locality						
Brazzaville	55	30.4	126	69.6	1	
Pointe Noire	27	20.1	107	79.9	0.58 (0.34-0.98)	0.041
Nkayi	5	12.5	35	87.5	0.33 (0.12-0.88)	0.029
Oyo	10	45.5	12	54.5	1.91 (0.78-4.68)	0.153
Type of household						
Single-parent	18	29.5	43	70.5	1.84 (0.61-2.28)	0.613
Two-parent	41	26.1	116	73.9	1	0.764
Household size						
<3	1	25.0	3	75.0	1	
3-5	25	24.3	78	75.7	0.96 (0.10- 9.66)	1.000
>5	33	29.7	78	70.3	1.27 (0.13-12.65)	1.000
Socioeconomic level						
Low	32	25.2	95	74.8	1	0.594
Medium	27	30.0	63	70.0	1.27 (0.70-2.33)	0.433
High	0	0.0	1	100.0	-	1.000

Table 2. Risk factors for parasitized children related to latrine type, hand hygiene, food hygiene and drinking habits.

Variables	Intestinal parasitosis		OR (IC95%)	p-value
	Yes	No		
Latrines type				
Modern	26 (28.0)	67 (72.0)	1.08 (0.59-1.98)	0.798

Traditional	33 (26.4)	92 (73.6)	1	
Communal latrines				
Oui	35 (23.2)	116 (76.8)	0.54 (0.29-1.01)	0.053
Non	24 (35.8)	43 (64.2)	1	
Washing hand after using the toilet				
Oui	6 (25.0)	18 (75.0)	0.89 (0.33-2.35)	0.809
Non	53 (27.3)	141 (72.7)	1	
Tap water consumption				
Yes	46 (26.6)	127 (73.4)	0.89 (0.43-1.85)	0.757
No	13 (28.9)	32 (71.1)	1	
Borehole water consumption				
Oui	12 (30.8)	27 (69.2)	1.25 (0.58-2.66)	0.565
Non	47 (26.3)	132 (73.7)	1	
Food preservation methods				
Modern	44 (31.2)	97 (68.8)	1.88 (0.96-3.65)	0.062
Traditional	15 (19.5)	62 (80.5)	1	
Raw food consumption				
Yes	28 (26.9)	76 (73.1)	0.99 (0.54-1.79)	0.964
No	31 (27.2)	83 (72.8)	1	
Cleaning food before consumption				
Yes	27 (28.4)	68 (71.6)	3.18 (0.38-26.63)	0.439
No	1 (11.1)	8 (88.9)	1	
Consumption of street food				
Yes	27 (31.0)	60 (69.0)	1.39 (0.76-2.55)	0.282
No	32 (24.4)	99 (75.6)	1	
Washing hands before meals				
Yes	54 (27.6)	142 (72.4)	1.29 (0.45-3.68)	0.629
No	5 (22.7)	17 (77.3)	1	

DISCUSSION

Prevalence of intestinal parasitosis

The overall prevalence of intestinal parasitosis in our study was 25.7%. In the literature, the prevalence of intestinal parasitosis varied from one country to another and from one locality to another within the same country. In the Democratic Republic of Congo, for example, Kapiteni et al. reported a prevalence of 94% in North Kivu [13], some four times higher than that found here. This remarkable difference for these two neighbouring countries could be explained not only by the precarious socio-economic and hygienic conditions of the inhabitants of the locality where the study was carried out, but also by the fallout from socio-political unrest in this part of the country. Other authors in Africa have noted a high prevalence of intestinal parasitosis in children in particular and in the population in general. These include Tligui in Morocco: 57.1% [14], Adou Bryn in Côte d'Ivoire: 38.9% [15], Ould Ahmed Salem in Mauritania: 33.4% [16], Soumana in Mali: 33.0% [17], Diouf S in Senegal: 31.3% [18]. Elsewhere in the world, Panti-May in Mexico: 65.1% [19]. In Colombia, Hernandez et al. reported a prevalence of 100% among school-age children in one locality, considered to be an indicator not only of poverty but also of very poor living conditions for the population, especially children, who are the main victims of this major public health problem [9]. However, we also found prevalences of intestinal parasitosis that were much lower than the figures we obtained. These include Zemene in Ethiopia, with a prevalence of 17.4% [20]; Ihéjirika in Nigeria, with 16.6% [21]; and Forson in Ghana, with 15% [8].

The prevalence of intestinal parasitosis has also been found in similar proportions in Africa and in other countries overseas. Dessie, Alemu and Kassaw, all in different parts of Ethiopia, reported 29.9%, 27.1% and 21.9% respectively, while Villanizan in Colombia reported 25.9% [24]. This disparity between countries and localities within the same country is due to a number of factors, ranging from socio-economic, hygienic and sanitary conditions, to local customs and traditions, all of which can favor the occurrence of intestinal parasitosis. Our study also revealed this disparity, which, however, was not very striking in our country. Although the prevalence of intestinal parasitosis varied from one locality to another, there was no statistically significant difference (p>005).

Although the average age of the children in our study was 9.65 ± 2.14 years, with extremes of 5 and 14 years, intestinal parasitosis was more frequent in female than male children, with no statistically significant difference. This was also noted by Soumana in Niger [17]. However, the age group most concerned was that of 5-7 year olds, with a prevalence of 31%, which could be explained by the fact that young children are more in contact with the ground, prone to the practice of geophagy [25] and the predominance of long fingernails in this category of children [26]. A study carried out in Senegal by Faye et al. revealed that for all age groups from 4 years upwards, the infestation rate was much higher for children under 15 [27].

Comparing our data with those obtained by Richard A in 1988, we note that the decrease in prevalence is only one point in over 30 years. This may be evidence of a lack of improvement in hygiene and socio-economic conditions in our country or it may reflect increased exposure to risk factors in both urban and rural populations. Hence the urgent need not only to accelerate control strategies, but also to improve or even increase awareness of these intestinal parasites, which ultimately represent a health and economic burden for the population. The multi-faceted support of all those involved in the fight against parasitosis would make a major contribution to reducing their burden.

Risk factors for intestinal parasitosis

We did not identify any hygiene-related risk factors for the infestation of intestinal parasitosis in parasitized school-age children. Only the localities of Nkayi and Pointe Noire were identified as risk factors for intestinal parasitosis in school-age children. This result seems difficult to explain. But in the context of the COVID 19 Coronavirus pandemic in which we live, the observance of barrier gestures including frequent and regular hand-washing, the restriction of children's gatherings and public play may explain this finding. In addition, the systematic deworming of schoolchildren in certain departments could be an obvious reason. For some years now, the Congo's strategy for dealing with intestinal parasitosishas been to systematically deworm school-age children during the various community interventions of schistosomiasis control programs and during vaccination campaigns organized by the Expanded Program on Immunization. The Pointe Noire and Nkayi localities were certainly at risk due to the low socio-economic level of the population and the uncontrolled expansion of the town. It should also be noted that the fact that Nkayi is a rural area may explain this result. This is due to the limited number of modern toilets in households, with the corollary of a large number of traditional toilets and defecation in the wild, which is a factor in the dissemination of parasites in nature when a subject is parasitized.

However, other studies have pinpointed factors associated with the risk of infestation in schoolchildren that vary from country to country. Hernandez in Colombia, in a multicenter study, reported the absence of periodic systematic deworming [9], as did Kassav in Ethiopia [23].

In Ghana, family size was found by Forson [8]; in Senegal, age, malnutrition and the presence of anemia were the associated factors found by Diouf [28].

However, in the DRC, several factors were found by Kangoy Mbala, including the parents' level of education and the family's low socioeconomic level. [29]. But these were not found in the present work, even though the Democratic Republic of Congo and the Congo may have the same sanitary, hygienic and economic realities.

ETHICAL ASPECTS

Ethics clearance n°372/MESRSIT/IRSSA-CERSSA was obtained from the Congo Health Sciences Research and Ethics Committee. Research authorizations have been issued by the Faculty of Health Sciences and by the Ministry of Primary and Secondary Education and Literacy.

ACKNOWLEDGEMENTS

Administrative authorities, heads of schools, parents of pupils and parents of pupils, hospitals where the analyses were carried out.

CONFLICTS OF INTEREST

None

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