



## Research Article

# EPIDEMIOLOGICAL PROFILE OF INTESTINAL HELMINTHOSIS IN AN URBAN SCHOOL ENVIRONMENT IN THE SOUTH-EAST REGION OF CÔTE D'IVOIRE

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**Abstract-** This study reports the results of a copro-parasitological investigation undertaken in seven cities located in the South-East of Côte d'Ivoire from 1996 to 2001. The stools of 2551 pupils aged from 4 to 15 years old including 1351 male subjects and 1200 female subjects were subjected to a direct examination, of the Kato and Baermann techniques. Moreover, the research of oxyure eggs was done by the Graham scotch anal test. The study revealed that 4.15 % of the pupils were mono or poly parasited with a statistically significant difference between the two genders. The most affected age group range is the one between 10 to 15. The most affected cities were Grand-bassam (59.70 %), Abidjan (51.42 %), Divo (47.50 %). Trichocephalosis, ascariidiosis and ankylostomosis represented respectively 18.57 %, 11.53 % et 9.94 % of the intestinal helminthosis found. The other worm infestations were rare.

**Keywords-** Intestinal Helminthosis, School, Côte d'Ivoire.

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## Introduction

The intestinal parasitoids are very frequent in an tropical environment [1-11]. They affect around two billion people in the world [12]. Among these affections, the intestinal heminthosis, notably the Soil-transmitted helminthes (STHs) infections and the schisthosis because of their wide distribution made it major endemics. Worldwide it is estimated that in 2010, 439.9 million people were infected by the ankylostomosis, 819 million by *ascaris lumbricoïdes* et 464.6 million by *Trichuris trichiura*.

Ahead of AIDS, malaria and tuberculosis that draw the most attention in the world, these endemic parasitic affections, that have a very unfavourable impact on the life of the poor populations remain highly neglected by the world public health action [13], making geohelminthosis and schistosomosis neglected tropical diseases. The infection by intestinal helminthosis is responsible for the morbid state which severity is linked to the intensity of the infestation. It is often among children from 5 to 15 years old that the infestation rate is the highest. When the parasitic load is important, the symptoms appear. Among the symptoms there are the anemie, the slow growth, a decline in physical capacities as well as school performance and attention [14-20]. To address this situation, the WHO is becoming more and more aware of the importance of these diseases for public health, particularly in developing countries where poverty goes together with malnutrition, insanitariness, the lack of clean water and the poor state of health infrastructures. Regular preventive chemoprophylaxy implemented by the WHO enables to highly reduce the morbidity load du to these parasitoids [12].

In Côte d'Ivoire, a country located in the sub-saharan area, the intestinal parasitosis are endemic. In this study, we undertook to analyse data originating from transversal investigations conducted by the department of parasitology of the

faculty of research and training of the Felix Houphouet boigny University on the epidemiologic profile of intestinal helminthiasis in seven cities located in the south-eastern forest area of Côte d'Ivoire from 1996 until 2001

## Study Area

In Côte d'Ivoire, the South region is known for its climate of the humid tropical type, characterized by four seasons, including a major and a small rainy season ; a major and small dry season. The hydraulic network is heavy with two major rivers (the Sassandra and the Bandama) and many small rivers. The average rain fall is relatively abundant, going from 1203.6 mm to 1392 mm of rain fall per year, and a monthly average temperature ranging from 25.8 °C à 26.3 °C [21].

## Type of study

This is a syntesis study, combining the results of a series of independent transversal studies on the epidemiology of intestinal helminthiasis in seven cities of the south-eastern forest area of Côte d'Ivoire: Abidjan, Abengourou, Aboisso, Adzopé, Agboville, Divo et Grand-bassam [Fig-1].

## Materials and Methods

From 1999 to 2001, 2551 stool samples from investigations conducted on intestinal helminthiasis with children aged from 4 to 15 were submitted to the parasitology laboratory. The children included in the study were the ones registered in a primary school of the investigation city and who had not been treated against worm infestation three months before the beginning of the study. The choice of the schools and of the pupils was done by simple random sampling. For each case, the stool came along with a sleep which enabled to obtain socio

demographic and epidemiologic information on the pupils. Each sample was subjected to a macroscopic examination, a microscopic examination after diluting pieces of stool in a drop of physiological water and a microscopic examination after concentration by the clearing KATO method in order to look for helminth eggs.



Fig-1 Geographical location of the cities the sites of the study in the South-East of Côte d'Ivoire (heavy humid forest area of the South-East) [21]

The specific search for oxyures eggs was done by the GRAHAM anal scotch test in Abidjan, Divo, Agboville, and Adzopé. The input and the analysis of the collected data were made by the Epi Info 6.04 with a signification line fixed at 0.05.

Results

Table-1 The Prevalence of Intestinal Helminth Infections according to the socio-demographic data and by city

	No. Examined	No. Infected	Prevalence % (IC <sub>95%</sub> )	RR (IC <sub>95%</sub> ) N
<b>Global Prevalence</b>	2551	1059	41.51 (39.59-43.45)	
<b>sex</b>	<b>P &lt; 0,0001</b>			
Male	1351	620	45.90 (43.02-48.60)	1.0
Female	1200	439	36.60 (33.80-39.40)	0.65 (0.60-0.72)
<b>Age</b>	<b>P &lt; 0,0001</b>			
(4 – 9)	1143	292	25.54 (23.04-28.18)	1.0
(10 – 15)	1408	627	44.53 (47.96-53.70)	0.57 (0.51-0.64)
<b>Cities</b>	<b>P &lt; 0,0001</b>			
Abengourou	402	84	20.89 (17.02-25.20)	1.0
Adzopé	360	116	32.22 (27.41-37.32)	0.65 (0.51-0.83)
Agboville	363	135	37.19 (32.20-42.38)	0.56 (0.45-0.71)
Aboisso	336	152	45.23 (39.83-50.73)	0.46 (0.37-0.58)
Divo	360	171	47.50 (42.20-52.9)	0.44 (0.35-0.55)
Abidjan	420	216	51.42 (46.53-56.30)	0.41 (0.33-0.50)
Grand-bassam	310	185	59.70 (53.98-65.18)	0.35(0.28-0.43)

Much higher prevalence were reported among children aged from 4 to 15 in the district of Kupwara located in the north of the Kashmir valley in India (71,15 %) [23], in rural environment respectively among children in Malaysia (87,4%), [24] and among subjects aged from 2 to 80 in Indonesia in 2014 (95,5%), [25] .

In total, out of 2551 stool samples analyzed all methods put together, 1059 collections were positive that is an average parasitism rate of 41.5 %. The features of the population analyzed and the prevalence of intestinal parasitoids are reported on charts 1 to 2.

Discussion

Even though the prevalence investigations were not all conducted during the same period, this compilation work has the merit to give account of the epidemiology of the intestinal heminthosis in the South-East of for the first time in Côte d'Ivoire. The data that we are processing in this work and which originate from investigations conducted between 1999 and 2001 have never been published. Since 2002, Côte d'Ivoire has gone through socio political crisis, which worsened the socio sanitary situation of the country. In 2007, with the support of the national programme for the fight against the Soil-transmitted helminthes and schistosomiasis, we noted mass worm infestation treatment activities. Studies are in progress and concern the epidemiologie of intestinal helminthiasis in the entire country. Publishing such, data would enable to take a look on the evolution of intestinal helminthiasis. Only the KATO concentration technique was used in all the cities during the different investigations. However, the results of our study seem to be a good representation of the prevalence of parasitic diseases in the region. At the end of our study, around two children out of five were suffering from one or many intestinal helminth infections. This frequency is relatively high, thus confirming the endemic state of these affections in that region of Côte d'Ivoire. [1, 2, 22]. The prevalence of intestinal helminthosis is not homogenous, it varies from 20,89 % to 59,70% from one city to another with a statistically significant difference. This prevalence is higher in the cities of Grand-Bassam and Abidjan. The further we move away from the coast, the more the prevalence declines. The rate of intestinal parasitism relatively high in the cities near the coast can be linked on one hand to the density of the population. Indeed, the intestinal parasitoids are for most of them a direct reflection of the level of individual and collective hygiene. The demographic explosion and the trend toward the urbanization of the population of deprived countries bring about the multiplication of shanty towns, which worsens the precariousness of hygiene. On the other hand, the conditions of humidity and heat are more appropriate to the transmission of helminthes in the forest region as noticed by Evi [22] in a similar study in six cities in the South West forest region of Côte d'Ivoire. To these factors, let us stress that the cities of Abidjan and Grand bassam are facing waste water drainage. The stagnation of waste water fosters many diseases including parasitosis. The relative low infestation rates of infestation observed in the cities of Adzopé, Agboville and Abengourou suggests a better sanitary situation in these cities.

However our result remains closer to those found [26] among orphans in the North-East of Poland (46.3%) between 2003 and 2006, in 2011 among aborigeneses (children and adults) coming from different regions of Perak in Malaysia (50,6 %), [27], and in 2016 in a school environment respectively in the

North-West (35.2%) and in the South of Ethiopia [11, 28]. Other authors reported much less prevalence ranging between 10% to 28% [10, 26].

The boys are statistically more infested than girls ( $p < 0.0001$ ) in our work. We think that the boys who are less required to carry out household chores than girls, practice games that expose them to intestinal parasite infestation. These results

match other studies conducted in Côte d'Ivoire [22], in Haiti [27]. On the other hand, the predominance of intestinal helminthosis with girls was reported in Malaysia [24]. However, in the Nigerian population [10], the intestinal helminthosis equally affects boys and girls.

**Table-2** Mean number of Intestinal Helminths Infections in various city of South-East, Côte d'Ivoire

Helminths	Grand-bassam (a)	Abidjan (b)	Divo (b)	Aboisso (a,b)	Agboville (b)	Adzopé (b)	Abengourou (a,b)	%
	%	%	%	%	%	%	%	
<i>Trichuris trichiura</i>	52.9	30	10.28	10.71	13.49	8.89	3.73	18.57
<i>Ascaris lumbricoides</i>	8.7	3.57	16.66	17.87	14.87	9.17	9.95	11.53
hookworms	21.6	13.10	5	14.28	5.5	3.89	6.21	9.94
<i>Enterobius vermicularis</i>	0.3	19.29	8.06	0	6.88	8.33	0.24	6.15
<i>Schistosoma mansoni</i>	1.3	0.95	6.11	6.84	9.91	1.39	2.98	4.21
<i>Strongyloides stercoralis</i>	1.6	2.14	1.11	0.90	0.27	0.56	0.74	1.04
<i>Hymenolopis nana</i>	1.3	0.95	0.28	1.78	0	0.28	0.49	0.72
<i>Taenia sp</i>	0	0	0	0	0	0.83	0	0.11
<i>Fasciola hepatica</i>	0	0	0	0	0	0.28	0	0.04
Multiple infections	39.5	31.5	32.2	13.8	28.1	31.9	17.9	27.84

(a) Cities where specific search for oxyures eggs was not done

(b) villes where Ritchie méthode was not done

The predominance of intestinal helminthosis found among children aged from 10 to 15 ( $p < 0.0001$ ) is found in other studies realized in Nigeria and in Kenya [28, 29]. In our work, this ascertainment could be explained by the fact that in this age group children undergo less strict surveillance by parents. Furthermore, they are not aware of the importance of individual and collective hygiene in the prevention of intestinal helminthiasis infestations.

A study conducted in Malaysia shows that the infestation is statistically more marked among children aged 4 to 9 years old.

Concerning the helminthes involved, there is no new fact as far as the predominance of Soil-transmitted helminths (STHs) infections is concerned in developing countries [13]. *Trichuris trichiura* (18,57%), *Ascaris lumbricoides* (11,53%) and of *Necator americanus* (9,94%) occupy the first ranks as it is the case of a study conducted in the South-West of Côte d'Ivoire [22]. The relatively high rate of oro-faecal transmission nematodosis. In this study reflects a poor sanitary development in that region. This situation seems worse in certain regions of Africa and Asia. The results of many studies a predominance of more marked oro-faecal transmission parasitoids. Indeed, a study conducted in Nigeria in 2011, in a school environment by Abah [10] showed an infestation rate of 51,78% and 15,18% due respectively to *Ascaris lumbricoides* and *Trichuris trichiura* 15,18%. Two other studies conducted in Malaysia [24], and in Indonesia [25] revealed a very high prevalence of these Soil-transmitted helminthes (STHs) infections showing respectively rates of 40,5%, 65,8% and of 65,8%, 60,4% of *Ascaris lumbricoides*, and *Trichuris trichiura* parasitism.

In our series, the prevalence of ankylostomes is however, less high than the one of the study conducted in Bondoukou (23%), city in the North of Côte d'Ivoire located in the savannah region [30]. This difference in prevalence could be explained by the difference in climate and sanitary level between these two Eco climatic areas. Very high rates were reported in other studies: 50,2% in Tanzania [31], 76,8% in Laos [32] et 53,5% in Kalena Rondo, a village located in East Indonesia [25]. Globally, the prevalence of oxyurosis is underestimated, the GRAHAM anal scotch test not having been done among all the children during the different investigations. However if we consider the results obtained in the cities where the anal scotch test was conducted, our results: 19,29%, 8,33%, 8,06% and 6,88% respectively in Abidjan, Adzopé, Divo, and Agboville are relatively high and could be caused by the closeness [33]. Indeed the areas where there is frequent close contact with infected people, notably in orphanages, nurseries, foster contamination [26, 9]. The analysis of our results on the prevalence of oxyurosis in Abidjan indicates that it seems to have increased. Indeed the rate of this parasitoid was close to 6,25% in 1996 among preschool children [34]. Including school age children in our series could explain these high figures [26]. However in the Nigerian and Chinese [35,7] populations the proportion of children affected is low; respectively 0,3% et 0,15%. At the methodological level, not conducting the BAERMANN technique could explain the low number of

anguillulosis cases found in our series as it was the case in the South-West of Côte d'Ivoire [22]. However, the prevalence of this affection nears the one reported (2,7%) in another study conducted in the city of Abidjan [37], while this author used the BAERMANN technique in his study, the appropriate method for the extraction of d'anguillule larvae. From this finding, we can say that the prevalence of anguillulosis is underestimated in our series.

The multi-parasitism and the scarceness of other worms (Hymenolepiase, Taeniasis) are notions that appear in the majority of recent publications [23,10]. Around one child out of three is polyparasited. Among children this situation raises serious health problems. Indeed, poly parasitism can lead to serious clinical manifestations such as anemia, the drop in work capacity and the slow down of growth among children.

#### Weakness of the study

The weaknesses of this study come from the fact that the prevalence data on intestinal helminthiasis are global and originate from investigations conducted at different periods and years. The features of the environment for each city being able to constitute risk factors in the infestation of intestinal parasite, were not published in the different investigation. Therefore, we could not look for an association between explaining variables in relation with the environment features of each city and the different prevalences reported from the odd ratio analysis. Furthermore, other factors that were not mentioned in this work, such as the socio economic feature, the defecation behavior, children hygiene according to the cities could explain these prevalence differences.

#### Conclusion

Our study reveals that the level of parasitic endemic in the South-East forest region of Côte d'Ivoire is relatively high with a high rate of intestinal helminthosis from 1999 to 2001. A good knowledge of the variable which could explain these prevalence differences at the level of each city is essential to undertake action in order to reduce the prevalence. Moreover, this work gives basic information that will be used as reference to appreciate the evolution of the intestinal helminthiasis since the setting up of the campaign activities for mass worm infestation treatment by the national programme for the fight against Soil-transmitted helminthes.

#### Abbreviations: None

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**Author Contributions:**

Angora KE contributed to the statistical analysis of the data  
Yavo W, Angora KE<sup>1</sup>, Konate A, Kassi FK, Bedia-Tanoh AV<sup>1</sup>, Vanga-Bosson AH<sup>1</sup>, Djohan, et Menan EI<sup>H</sup> Took part in the writing and the correction of the document

**Conflict of interest:** We declare that we have no conflict of interest concerning the work reported in this paper.

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