Chapter 4

Prevalence and Intensity of Intestinal Parasites and Malaria in Pregnant Women at Abobo District in Abidjan, Côte d'Ivoire

Gaoussou Coulibaly, Kouassi Patrick Yao, Mathurin Koffi, Bernardin Ahouty Ahouty, Laurent Kouassi Louhourignon, Monsan N'Cho and Eliézer Kouakou N'Goran

Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/intechopen.79699

Abstract

A prospective study was carried out from 2010 to 2012 at the Hôpital Général d'Abobo (HGA) in Abidjan, in order to determine the impact of infectious and parasitic diseases on child cognitive development. Blood samples were examined by means of drop thick and blood smear, as for stool by direct examination and concentration by formalin-ether method. We evaluated the prevalence and the parasite load of malaria and gastrointestinal parasites and then investigated the risk factors for these disorders. Overall, 331 pregnant women in the last trimester of their pregnancy were enrolled. The plasmodic index was 3.9% with an infestation specific rate for *P. falciparum* of 100%. Concerning digestive protozoa, it has been observed 71.3% of nonpathogenic, against 9.7% of pathogens, either an overall prevalence of 51.4% of digestive parasites. The calculated average parasitic loads revealed 3089.2 tpz/μl of blood (95% CI, 591.1–5587.3) for malaria, 6.5 eggs per gram of stool (95% CI, 0.4–13.4) for intestinal helminths, and one (1) parasite by microscopic field for protozoa (common infestation). It has been shown that the occurrence of malaria has been linked to the nonuse of impregnated mosquito nets ($\chi^2 = 0.012$, $p = 0.018$) to age. No link could be established between the presence of digestive parasites and the age of pregnant women or socioeconomic conditions (level of education, profession, type of toilet). Malaria is less common in pregnant women, while the rate of digestive parasites remains high.

Keywords: Abidjan, Côte d'Ivoire, intestinal parasites, malaria, pregnant women

1. Introduction

Intestinal parasitosis and malaria remain the most important diseases in sub-Saharan Africa [1, 2]. With hundreds of millions of sick people every year and about three million deaths per year, intestinal parasites and malaria remain the most important diseases in sub-Saharan Africa and mainly affect children and pregnant women [3, 4].

In pregnant women, these parasitic infections cause maternity accidents such as premature births, maternal-fetal death, and malformations [5–7].

In Côte d'Ivoire, malaria is the main cause of morbidity (40%) and mortality (10%) in the general population. Children under 5 years and pregnant women are the most affected. In addition to malaria, Côte d'Ivoire is facing other diseases such as intestinal parasitosis.

Long rural the tropical countries are confronted with the urban growth, with the biggest upheavals of the lifestyles of its history. Urbanization rate increased from 27.3% in 1975 to 49% in 2000 according to the United Nations estimates [8]. This represents an increase of about 1.3 billion people. Cities on the African continent are currently experiencing the strongest growth. The urbanization rate, which was only 13.2% in 1950, exceeded 37% in 2000, i.e., 270 million more urban dwellers [9]. This was the case for the city of Abidjan, the economic capital of Côte d'Ivoire, and more precisely in the municipality of Abobo. The urbanization of this town, which began in the 1970s, is so fast that nowadays Abobo already has more than one million inhabitants. However, infrastructure development has not kept pace with these rapid changes. In this context, precarious housing areas focus on pathologies linked to promiscuity, insalubrity, lack of drinking water supply, and/or poverty; these diseases are intestinal parasitosis and malaria [10, 11]. Moreover, it must be noted that few studies have been carried out on these parasites and particularly on pregnant women in this municipality. As part of a research project on the impact of infectious and parasitic diseases on the physical and mental development of children, pregnant women were followed up. The work consisted of evaluating the prevalence, parasite load of malaria, and digestive parasites and then determining risk factors of these parasitic infections in pregnant women in Abobo district in Abidjan.

2. Materials and methods

2.1. Study area and population

Our prospective study, which took place from May 2010 to June 2012 at the General Hospital of Abobo (GHA) in Abidjan, involved 331 pregnant women recruited in the last quarter of pregnancy; these future mothers all provided informed consent before being included in the study. They were aged 18–46 years. The mothers were recruited during antenatal clinic visits by gynecologists. Detailed explanations of the study were given by them in local languages if necessary.

The fact sheets on the socioeconomic status and study of risk factors have been met by community health workers (CHWs) in an interview with the mother following the signing of

informed consent. It includes information on factors favoring the transmission of these parasites, namely, age, type of neighborhood, level of education, occupation, type of toilet, and use or not of impregnated mosquito nets.

2.2. Laboratory procedures: sample collection and parasitological analyzes

A blood sample of 5 ml was taken from patients by nurses, in a labeled EDTA tube (patient ID number) by venipuncture in the antecubital fossa, after disinfection of the sampling region by ethyl alcohol. Blood samples were stained in a solution of 10% Giemsa and microscopic reading of immersion oil at a magnification of 100. In the positive case, the parasitic identification was carried out on thin film, and parasite densities were evaluated from the thick drop of 200 or 500 leukocytes. Individual values obtained for parasitemia were finally reduced to microliter (1 μl) of blood on the basis of 8000 leucocytes by taking the product of the number of parasites obtained by 40 or 16, respectively, for 200 or 500 erythrocytes [12, 13].

A box for the stool sample was given to the mothers, and they were asked to return the next morning at the hospital with the boxes containing feces. The stools collected in the morning were labeled with the patient ID and were the subject of a direct microscopic examination between slide and cover glass. In addition, 1–1.5 g of stool was placed into a falcon tube containing 10 ml of sodium acetate–acetic acid formalin (SAF) solution, broken and homogenize with a wooden spatula and vigorously shaken. Within 1 month of stool collection, the SAF-fixed samples were subjected to an ether concentration method [14]; the SAF-fixed stool samples were re-suspended and filtered through medical gauze placed in a plastic funnel into a centrifuge tube. The first centrifugation is made at 2000 towers/min for 1 min. After centrifugation, the supernatant was discarded, and 7 ml of 0.9% NaCl plus 2–3 ml of ether was added to the remaining pellet. After shaking for 10–30 s, the tube and its content were centrifuged for 4–5 min at the same speed. Finally, from the four layers formed, the three top layers were discarded. The bottom layer, including the sediment, was examined under a microscope. With regard to the parasite load, the exact number of eggs of each species of helminth was marked; the presence of a species of protozoan was mentioned by a positive (+) sign. The number of + ranges from 1 to 3 depending on the intensity of the parasite. Indeed, 1+ corresponds to 1–5 parasites per analyzed microscopic slide, 2+ 1 parasite per microscopic field, and 3+ more than 1 parasite per microscopic field.

2.3. Statistical analysis

MS Excel software was used for entering data collected (parasitological data and those fact sheets) and perform figures.

Descriptive analysis was done to describe the data as counts, percentages, averages, using tables and figures. Statistical tests were carried out with the Stata software 11.0.

The chi-square test (χ^2) allowed us to appreciate the link between the occurrence of malaria and/or helminth infections and exposure factors (age, use of non-treated nets, socioeconomic conditions). The value of the probability (p) showed the degree of significance of the links at the 0.05 level. The Fisher exact test was used for small numbers (more than 5% of the theoretical frequencies less than 5).

2.4. Ethical considerations

The study conditions have been reviewed and approved by the National Ethics and Research Committee of Côte d'Ivoire (N ° 4169/MSHP). Detailed explanations of the study were given to mothers in local languages, if necessary. The participation was voluntary. When the mother consented, she signed or affixed a fingerprint on the informed consent sheet.

3. Results

3.1. Characteristics of study population

The study included 331 pregnant women from 13 neighborhoods in Abobo commune. The average age was 28.9 years old. The largest group of women was between 28 and 32 years old (31.7%) (**Figure 1**).

After the blood and stool examinations, 157 (47.4%) women presented no parasite. Four (4) women (1.2%) presented plasmodium, 161 (48.6%) digestive parasites, and nine (9) (2.7%) both parasites (**Table 1**).

3.2. Prevalence, parasite density, and risk factors of malaria

In total 13 women presented a positive thick smear of *Plasmodium* sp., with a parasite rate of 3.9%. Parasite mean of *Plasmodium falciparum* is 3089.2 trophozoïtes/µl of blood with a minimum of 360 trophozoïtes/µl and maximum of 13,400 trophozoïtes/µl. The highest prevalence (12.5%, 2/16) was recorded with the age group of 38 years and older and the lowest (1.2%, 1/83) with that of 23–27 years. The differences in prevalence observed between age groups are not statistically significant ($\chi^2 = 5.11$, p = 0.276). Infestation of *P. falciparum* is not age-related. Women not using treated nets are much more infested (6% 12/200) than those using insecticide (0.8%, 1/131). The parasitic porting is influenced by the use of treated mosquito nets ($\chi^2 = 0.012$, p = 0.018). Women not using bed nets are the most vulnerable to malaria (**Table 2**).

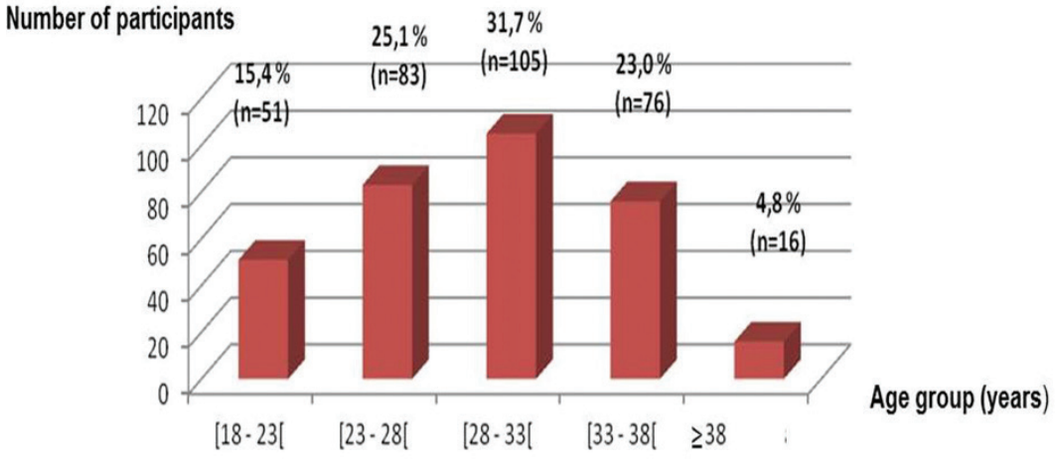

Figure 1. Distribution of population according to age.

Blood tests	Coprological analyzes		Total
	Negative digestive parasite	Positive digestive parasite	
Negative thick drop/blood smear	157 (47.4%)	161 (48.6%)	318 (96.1%)
Positive thick drop/blood smear	4 (1.2%)	9 (2.7%)	13 (3.9%)
Total	161 (48.6%)	170 (51.4%)	331 (100%)

Table 1. Distribution of participants according to the results of blood tests and stool.

	Using of treated mosquito nets		χ^2	p
	Oui	Non		
Number of participants	131	200		
Infected	1	12		
Prevalence (%)	0.8	3.9	0.012	0.018

Table 2. Prevalence of malaria according to the use or non-use of insecticide-treated bed nets.

Parasites species	Infected	Prevalence (%)
Protozoa		
Entamoeba coli	104	31.4
Endolimax nana	56	16.9
Blastocystis hominis	38	11.3
Entamoeba histolytica/dispar	23	7
Iodamoeba butschlii	15	4.5
Entamoeba hartmanni	12	3.6
Chilomastix mesnili	11	3.3
Giardia lamblia	9	2.7
Helminths		
Schistosoma mansoni	9	2.7
Trichuris trichiura	4	1.2
Ascaris lumbricoïdes	1	0.3

Table 3. Prevalence of intestinal parasites species.

3.3. Prevalence, infection intensities, and risk factors of intestinal parasites

After stool examinations, eight (8) species of intestinal protozoa belonging to six (6) different kinds were diagnosed in Abobo. These are *Entamoeba histolytica/dispar*, *Giardia lamblia*,

Endolimax nana, *Entamoeba coli*, *Iodamoeba butschlii*, *Chilomastix mesnili*, *Entamoeba hartmanni*, and *Blastocystis hominis*. The term "*Entamoeba histolytica/dispar*" was used because the method used for stool examinations did not allow to distinguish the species *Entamoeba histolytica* and *Entamoeba dispar*.

In addition to these protozoa, three species of helminths were observed: *Schistosoma mansoni*, *Trichuris trichiura*, and *Ascaris lumbricoides*. Of the 331 women screened, 170 were carriers of digestive parasites, with an overall prevalence of 51.4%. The prevalence of species of digestive parasites (pathogenic and nonpathogenic protozoa of digestive and intestinal helminths) is presented in **Table 3**. With protozoa, the highest prevalence was observed with *Entamoeba coli* (31.4%, 104/331) and *Endolimax nana* (16.9%, 56/331). Concerning intestinal helminths, in the three species, *Schistosoma mansoni* was the most abundant with a prevalence of 2.7%. In terms of parasite load protozoa, the trend observed in our study was 2+, namely, 1 parasite per microscope field, the latter being described as frequent infestation. As regards the helminths, the average worm burden was 7.8 eggs/gram of feces. The most infested age group is that of 23–27 years (59%, 49/83), while the least infested was that of 18–22 years (45.1%, 23/51). Age had no significant association with gastrointestinal parasites ($\chi^2 = 3.77$, $p = 0.438$). These parasites infest all age groups. No significant binding was recorded between the digestive parasites and level of schooling ($\chi^2 = 6.88$, $p = 0.76$), occupation ($\chi^2 = 2.66$, $p = 0.103$) (Table 5), and the type of toilets ($\chi^2 = 1.57$, $p = 0.456$). The occurrence of intestinal parasites is not related to the socioeconomic conditions.

4. Discussion

We examined 331 pregnant women of which 13 showed positive thick smear, with a parasite rate of 3.9%. Menan et al. [15] had reported in 1996 had a higher prevalence of 18.8% among the population of Abidjan. Our low rate could be explained by the fact that pregnant women receive intermittent preventive treatment (IPT) with sulfadoxine-pyrimethamine (SP) against malaria during pregnancy.

P. falciparum has been the only species identified during our work with a specific index of 100%. During these works in Côte d'Ivoire [16, 17], all cases of infection were also due to *P. falciparum*. By cons, it was highlighted at Taï southwestern Côte d'Ivoire the coexistence of *P. falciparum*, *P. malariae*, and *P. ovale* with specific rates of 84, 14, and 2% [18]. These studies highlight the prevalence of *P. falciparum* in Côte d'Ivoire (80–97% of infections) [19, 20].

The minimum parasitemia is 360 tpz/μl and the maximum 13,400 tpz/μl of blood. The average parasite density was 3089.2 tpz/μl of blood during the study. Our low parasite density could be explained by the fact that we have a gradual reduction in parasite densities with age [19]. Furthermore, it was suggested that the gradual decline in parasite densities with age is associated with the acquisition of immunity [21].

Our study revealed that the incidence of malaria is not related to age of the pregnant woman. This observation is similar to that of Menan et al. [15] in 1996 at the Abidjan population.

http://dx.doi.org/10.5772/intechopen.79699

It appears from our study that there is a link between malaria and the use or non-treated nets. Women using treated nets are much less infested than those not using bed nets. Furthermore, the use of treated nets is a means of prevention against malaria [22].

During our study, slightly more than half of pregnant women were carriers of digestive parasites (pathogenic and nonpathogenic protozoa and intestinal helminths), with a rate of 51.4%. This rate is similar to that reported in pregnant women from Abidjan and its suburbs (53.6%) [23]. This demonstrates that the digestive parasites remain in pregnant women in Abidjan and maintain their level of infestation. The most common species of protozoa in our study area are nonpathogenic species *E. coli* (31.4%) and *E. nana* (16.9%). This same predominance was observed in 1993 among pregnant women in Abidjan [23]. The both pathogenic species of digestive protozoans (*E. histolytica/dispar*, *G. lamblia*) have a cumulative rate of 9.7%, which is substantially equal to that commonly found in children of school age (9.1%) [24], which demonstrated that this pathogenic protozoa infest either the mothers or the children in our study area.

Overall, helminths are not often found in our study. The predominant species is *Schistosoma mansoni* (2.7%), followed by *Trichuris trichiura* (1.2%) and *Ascaris lumbricoides* (0.3%). The prevalence of *Schistosoma mansoni* (2.72%) is in the prevalence interval (0.1–7.5%) indicated in Ivorian urban areas [25]. Prevalence close to that obtained in this study, namely, 3.1 and 3.9%, has been reported in Abidjan [26, 27]. This rate is higher than that observed (0.8%) among school age children in Abidjan [28]. This prevalence is low compared to those found in Moapé (Adzopé) (75%) [29] and Azaguié (Agboville) (88%) [30]. It must be emphasized that Agboville and Adzopé are schistosomiasis endemic areas [29, 31]. *Trichuris trichiura* was found at a rate of 1.2%. This rate is superimposed on that of Raso et al. [30] in 2005 in Man (1.3%). A much higher rate than ours was obtained in Agboville (15%), in a study in schools [32]. Furthermore, it is clear that the prevalence of trichuriasis is significantly higher than in the forest zone savanna [25, 33]. However, our very low prevalence could be explained by the analysis technique (method of concentration by formalin-ether) used. The prevalence of *Ascaris lumbricoides* was 0.3%. In a survey in Toumodi, no cases of roundworm porting have been reported [34]. A prevalence of 31.2% of roundworm porting was noted in Bondoukou; they felt it was the most common parasite in north-western Côte d'Ivoire [35].

This situation of frequent infestation (one parasite per field) to protozoa may be explained by the fact that the clean Abobo has many shortcomings, namely, unhealthiness linked to the failure of systems' sewage and promoting fecal peril.

Regarding helminths, the low-average parasite burden (7.8 eggs/g of stool) could be the fact that we used direct examination and SAF technique for stool examination. These techniques are very sensitive for the detection of helminth species compared to the Kato-Katz technique. Furthermore, the technique of concentration by formalin-ether remains one of the most suited for the identification of intestinal protozoa techniques.

Our study reveals that the parasite carriage is not related to age. However, the age group most affected is that of 23–27 years (59%). This is consistent with that of N'Guemby and Le Bigot [36] in Libreville in Gabon which have found a high prevalence among participants from 21 to 31 years in 1981. This finding could be justified by the fact that this age range is very involved in the household.

Our study showed that there is no significant link between the species of digestive parasites and socioeconomic conditions (level of education, occupation, type of toilet). This same observation was made in adults residing in Bangkok, Thailand [37].

5. Conclusion

We noted a decrease in the rate of malaria in pregnant women compared with previous studies; the rate of digestive parasites remains high. These results appear in connection with the effectiveness of the policy against malaria despite the poor hygiene of these populations.

6. Summary

Intestinal parasitosis and malaria diseases, among others, remain the largest problem in sub-Saharan Africa; they mainly affect children (under 5 years) and pregnant women. Our study objective was to identify species of malarial and digestive parasites and to estimate the prevalence and intensity of infestation of these parasites and clarify the risk factors for these infections in pregnant women from the commune of Abobo. Our study was conducted at the General Hospital of Abobo (HGA) in Abidjan. This is a prospective study (2010–2012). Overall, 331 pregnant women in the last trimester of gestation, antenatal clinic goers, were recruited. They were aged 18–46 years. Blood samples were examined by thick film techniques and blood smears; stool samples were collected for direct examination, and method of concentration is formalin-ether. Intermittent treatment against malaria with sulfadoxine-pyrimethamine has contributed significantly to the reduction of malaria among pregnant women. The rate of digestive parasites remains high, indicating poor hygiene practice in these women.

Acknowledgements

We thank the Deutsche Forschungsgemeinschaft Germany (DFG) for the financing of this project. We are grateful to the director and the staff of Hôpital Général d'Abobo (Abidjan, Côte d'Ivoire) and community health workers (CHW) for their support and for facilitating the implementation of our study. We thank the pregnant women (mothers) for their enthusiastic participation.

Conflict of interest

There is no conflict of interest.

Author details

Gaoussou Coulibaly[1]*, Kouassi Patrick Yao[1], Mathurin Koffi[2], Bernardin Ahouty Ahouty[3], Laurent Kouassi Louhourignon[1], Monsan N'Cho[4] and Eliézer Kouakou N'Goran[1]

*Address all correspondence to: gaoussoubrava@yahoo.fr

1 Laboratoire de Zoologie et Biologie Animale, Université Félix Houphouët-Boigny, UFR Biosciences, Abidjan, Côte d'Ivoire

2 Laboratoire des Interactions Hôte-Microorganisme-Environnement et Evolution (LIHME), Université Jean Lorougnon Guédé, UFR Environnement, Daloa, Côte d'Ivoire

3 Laboratoire de Génétique, Université Félix Houphouët-Boigny, UFR Biosciences, Abidjan, Côte d'Ivoire

4 Centre de Recherche et de Lutte contre le Paludisme (CRLP), Institut National de Santé Publique de Côte d'Ivoire, Abidjan, Côte d'Ivoire

References

[1] Greenwood B, Mutabingwa T. Malaria in 2002. Nature. 2002;**415**:670-672

[2] Dianou D, Poda JN, Savadogo LG, et al. Intestinal parasite in the Sourou hydroagricultural system zone of Burkina faso. VertigO. 2004;**5**:3-10

[3] WHO. Burden of disease in disability-adjusted life years (DALYs) by cause, sex and mortality stratum in who regions, estimates for 2000. Report 2001, annex table 3. Geneva: WHO-Health statistics and informations; 2001

[4] Bejon P, Tabitha WM, Brett L, et al. Helminth infection and eosinophilia and the risk of *Plasmodium falciparum* malaria in 1-to 6-year-old children in a malaria endemic area. PLoS Neglected Tropical Diseases. 2008;**2**(2):164

[5] Van Heydan A. Intestinal Worms. Kinshasa: Ed Marketing; 1978. p. 80

[6] Bourée P, Leméteyer MF. Tropical Diseases and Pregnancy. Vol. 1 vol. Paris, France: Ed Pradel; 1990. 228 pp

[7] Bricaire, Gentilini M. Parasitosis and Pregnancy. Act Therap Internationale, Sanofi et Winthrop. 1993;**19**:10-11

[8] United Nations. Test estimation of the number of the men. Population. 2000;**1**:6

[9] UNICEF. Summary of Deworming Activities in West and Central Africa and joint WHO-UNICEF on Deworming. New York; 2006. p. 40

[10] Gentilini M. Parasitic diseases. In: Tropical Medicine. Paris: Flammarion Médecine-Sciences; 1995. pp. 159-173

[11] WHO. Treatment of Diarrhea. A Manuel for Physicians and Other Qualified Personnel. 4th rev. Geneva: World Health Organization; 2006. p. 43

[12] Henry MC, Rogier C, Nzeyimana L, et al. Inland valley rice production systems and malaria infection and disease in the savannah of Côte d'Ivoire. Tropical Medicine & International Health. 2003;**8**:449-458

[13] Iqbal J, Muneer A, Khalid N, et al. Performance of OptiMal test for malaria diagnosis among suspected malaria patients at the rural health centers. The American Journal of Tropical Medicine and Hygiene. 2003;**68**:624-628

[14] Utzinger J, Botero-Kleiven S, Castelli F, et al. Microscopic diagnosis of sodium acetate-acetic acid-formalin-fixed stool samples for helminths and intestinal protozoa: A comparison among European reference laboratories. Clinical Microbiology and Infection. 2008;**16**:267-273

[15] Menan EIH, Adou-Bryn KD, Mobio SP, et al. Total parasitological examinations of blood for malaria research at the Institut Pasteur de Côte d'Ivoire (I. P. C. I.). Médecine d'Afrique Noire. 1996;**43**(3):129-133

[16] Raso G, Utzinger J, Silué KD, et al. Disparities in parasitic infections, perceived ill-health and access to health care delivery structures among more and less poor school children of rural Côte d'Ivoire. Tropical Medicine & International Health. 2005;**11**:42-57

[17] Eholié SP, Ehui E, Adou-bryn K, et al. Severe malaria in Aboriginal in Abidjan (Côte d'Ivoire). Bulletin de la Société de Pathologie Exotique. 2004;**2551**:340-344

[18] Nzeyimana L, MC H, Dossou-Yovo J. Malaria epidemiology in the forest Southwestern of Côte d'Ivoire (Taï region). Bulletin de la Société de Pathologie Exotique. 2002;**95**(2):89-94

[19] Silué KD, Felger I, Utzinger J, et al. Prevalence, antigenic diversity and multiplicity of *Plasmodium falciparum* infection in school children in Central Côte d'Ivoire. Médecine Tropicale. 2006;**66**:137-142

[20] Yavo W, Ackra KN, Menan EIH. Comparative study of four biological diagnostic techniques used malaria in Côte d'Ivoire. Bulletin de la Société de Pathologie Exotique. 2002;**95**(4):238-240

[21] Smith T, Felger I, Tanner M, Beck H-P. Epidemiology of multiple Plasmodium falciparum infections. 11. Premunition in Plasmodium falciparum: insights from epidemiology of multiple infections. Transactions of the Royal Society of Tropical Medicine and Hygiene. 1999;**93**(Suppl. 1):59-64

[22] Koudou BG, Tano Y, Doumbia M, et al. Malaria transmission dynamics in Central Côte d'Ivoire: The influence of changing patterns of irrigated rice agriculture. Medical and Veterinary Entomology. 2005;**19**:27-37

[23] Penali LK, Broalet EY, Koné M. Helminth and protozoan infections in pregnant women in Côte d'Ivoire. Médecine d'Afrique Noire. 1993;**40**(5):353-356

[24] Konaté A. Support for carrying *Giardia intestinalis* cysts, *Entamoeba coli* and *Endolimax nana* by Metronidazole association and Diloxanide Furoate. The Pharma Abidjan. 2006; **1027**:108

[25] Doucet J, Assalé G. Epidemiology of intestinal helminths in Côte d'Ivoire. Médecine d'Afrique Noire. 1982;**29**(8-9):573-576

[26] Rouamba E, Menan EIH, Ouhon J, et al. Intestinal helminth infection: Results of five years of parasitic coprology at the Institut Pasteur de Cocody (Abidjan – Côte d'Ivoire). Médecine d'Afrique Noire. 1997;**44**(7):416-419

[27] Assalé G, Ferly-Therizol M, Koné M. Helminth and protozoan intestinal in Abidjan. Revue Médicale de Côte d'Ivoire. 1986;**75**:179-180

[28] Menan EIH, Nebavi NGF, Abjetey TAK, et al. Profile of helminthes among schoolchildren in Abidjan. Bulletin de la Société de Pathologie Exotique. 1997;**90**:51-54

[29] Nozais JP, Doucet J. The method of KATO: value compared with other methods of single stool examination in detecting intestinal helminths. Médecine d'Afrique Noire. 1976;**23**(numéro spécial):74-79

[30] Coulibaly TJ, Fürst T, Silué KD, et al. Intestinal parasitic infections in schoolchildren in different settings of Côte d'Ivoire: Effect of diagnostic approach and implications for control. Parasites & Vectors. 2012;**5**:135

[31] Guessand G, Koffi JK, Monges P. Intestinal helminths and public health. Médecine d'Afrique Noire. 1982;**29**(8-9):633-638

[32] Oga Agbaya SS, Yavo W, Menan EIH, et al. Intestinal helminths in schoolchildren: Preliminary results of the prospective study in Agboville in Southern Côte d'Ivoire. Cahier santé. 2004;**14**:143-147

[33] Nozais JP, Dunand J, Doucet J. Evaluation of the main intestinal parasites in 860 Ivoirian children from 13 villages. Médecine Tropicale. 1981;**41**:181-185

[34] Adou-Bryn D, Kouassi M, Brou J, et al. Prevalence of parasitosis to oral transmission among children in Toumodi (Côte d'Ivoire). Médecine d'Afrique Noire. 2001;**10**(48):394-398

[35] Penali LK, Adje E, Koné M, et al. Intestinal parasites in the region of Bondoukou (Côte d'Ivoire). Médecine d'Afrique Noire. 1989;**82**:60-64

[36] N'Guemby MC, Le Bigot P. Digestive parasites in Libreville. Bulletin Médical d'Owendo. 1981:37-39

[37] Pitisuttithum P, Migasena S, Juntra A. Socio-economic in Thaï. Adult residing in and around Bangkok metropolis. Journal of the Medical Association of Thailand. 1990; **73**(9):522-534

IntechOpen