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Original paper

Prevalence of intestinal parasitic infections among pregnant women in Bobo-Dioulasso (Burkina Faso)

Ibrahim SANGARÉ[1,2,3], Kiswendsida Thierry GUIGUEMDÉ[4], Adama ZIDA[4], Constant SIRIMA[3], Patindoilba Marcel SAWADOGO[4], Mamoudou CISSÉ [1,3], Sessinou Benoît ASSOGBA[5], Tinga Robert GUIGUEMDÉ[1,2,3], Sanata BAMBA[1,2]

[1]Institut Supérieur des Sciences de la Santé, Université Nazi BONI, Bobo-Dioulasso, Burkina Faso
[2]Centre Hospitalier Universitaire Souro SANOU, Bobo-Dioulasso, Burkina Faso
[3]Institut National de Santé Publique, Centre MURAZ, Bobo-Dioulasso, Burkina Faso
[4]Unité de Formation et de Recherche en Sciences de la Santé, Université Joseph Ki-Zerbo, Ouagadougou, Burkina Faso
[5]Disease Control and Elimination Department, Medical Research Council, Unit The Gambia at London School of Hygiene and Tropical Medicine, Gambia

Corresponding Author: Ibrahim Sangare; e-mail: babaibrasangare@yahoo.fr

ABSTRACT. Pregnant women are the most vulnerable populations exposed to intestinal parasitoses. To develop strategies to fight against these infections, it is essential to carry out regular surveys in order to provide reliable epidemiological data on intestinal parasitoses in at-risk populations. A prospective cross-sectional study was carried out from February to April 2015 in pregnant women seen during the prenatal consultation. The study took place in 3 health centers located in Health District of Dafra at Bobo-Dioulasso in Burkina Faso. The parasitological examination consisted in carrying out a standard stool parasitological examination and the modified Ziehl Neelsen staining. A total of 315 stool samples were collected and analyzed. The overall prevalence of intestinal parasitosis was 66.7% [95% CI: 61.1–71.8] with prevalences of 60.9% in Bolomakoté, 69.2% in Guimbi and 69.8% in Yéguérésso. Protozoa were the most encountered with of 66.0% prevalence and 1.3% of helminths. The most common protozoa species were *Entamoeba coli* (36.2%), *Giardia lamblia* (16.2%), *Entamoeba histolytica* (14.9%), *Cryptosporidium* sp. (12.1%) and *Trichomonas intestinalis* (10.5%). The helminths were represented by *Hymenolepis nana* (0.6%), *Strongyloides stercoralis* (0.3%) and *Dicrocoelium* sp. (0.3%). The prevalence of intestinal parasitosis is very high in pregnant women and dominated by protozoa. Most recently, it has been shown that metronidazole can be administered at all ages of pregnancy at a dosage of 1 g/day for 5 days for the treatment of intestinal protozoa in pregnant women. It would therefore be essential to evaluate this strategy in Burkina Faso by administering metronidazole concomitantly with sulfadoxine-pyrimethamine.

Keywords: intestinal parasitosis, prevalence, pregnancy, aneamia, Burkina Faso

Introduction

Intestinal parasitoses are a real worldwide public health problem. They are more widespread in tropical and subtropical countries with an estimated morbidity of 450 million people resulting 155,000 dead every [1]. The helminths and protozoa have several reservoirs which exposed vulnerable people to their infections [2,3]. Soil-transmitted helminths alone infested almost a quarter of vulnerable populations (such as school-aged children, young women and pregnant women [1].

In endemic areas, the pregnancy constitutes a vulnerable state to the development of these parasitoses with harmful consequences (morbidity and mortality) [3]. However, in pregnant women, intestinal parasites are responsible for nutritional status deterioration, internal bleeding with gestational anemia, premature births, maternal-fetal death, unexplained miscarriages and complicated pregnancies [3,4].

Burkina Faso has faced strong urbanization for

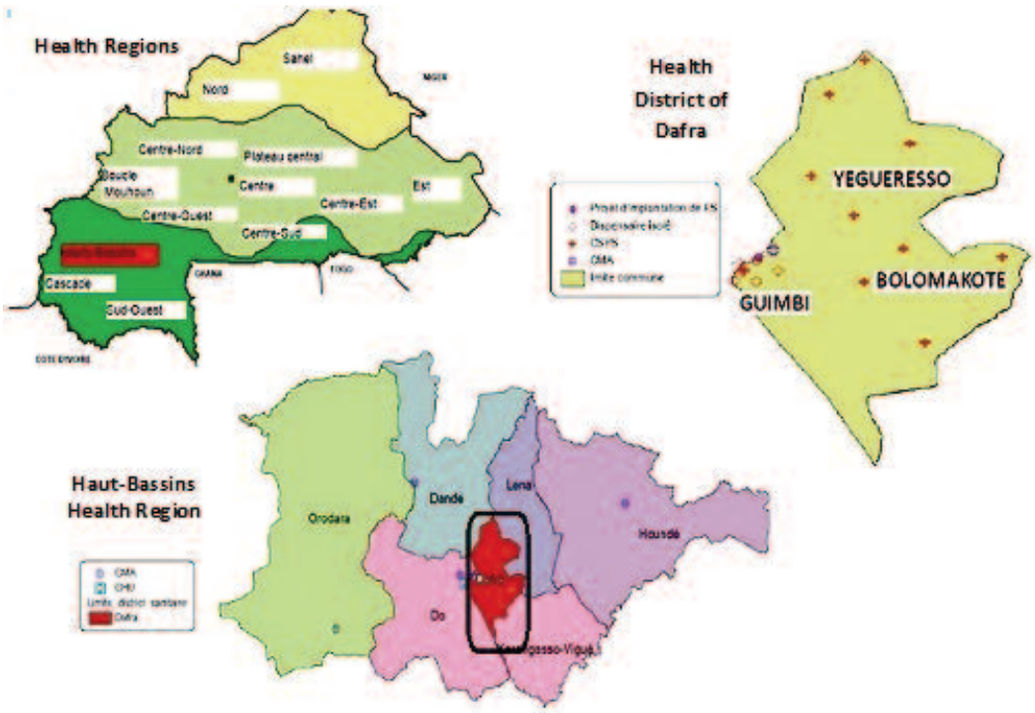

Figure 1. Health regions of Burkina Faso and Dafra health district

decades, with unplanned and uncontrolled permanent migration of rural populations to urban areas [5]. This population migration has changed the lifestyle of populations (precarious housing on the outskirts of the cities). This situation was not accompanied with infrastructures development and caused poor drinking water supply, promiscuity and unsanitary conditions. A such situation favored the emergence and dissemination of intestinal parasites in the population [2,5]. However, children's life depends on the positive experience of the pregnant mother and intestinal parasites could jeopardize this with complication during the pregnancy, childbirth and newborn. Consequently, WHO recommended anti-helmintic preventive treatment for pregnant women after the third trimester in endemic areas to reduce the burden of intestinal worm infections [6]. This treatment had contributed to the reduction of soil-transmitted helminths incidence, maternity accidents cases and anemia during pregnancy [3,4,7]. Moreover, the protozoa (*Entamoeba*, *Endolimax*, *Enteromonas*, *Giardia*, *Trichomonas*, *Cryptosporidium*, *Cyclospora* and Microsporidia) cause also a child and pregnant women mortality and morbidity in resource-poor settings such Burkina Faso [8]. For example, *Cryptosporidium* alone, was found to be one of the leading causes of infectious diarrhoea in children, and infection with this parasite is strongly associated with mortality, growth stunting, and developmental deficits [9]. However, there is neither a vaccine nor an effective chemoprevention treatment against these protozoa.

In Burkina Faso, the prevalence and epidemiological data on intestinal parasitic infections in pregnant women are really limited. Here, we conducted this study to assess the prevalence of these protozoa and helminths in pregnant women in Burkina Faso in order to better develop strategies for improving the positive experience of pregnancy and the quality of neonatal life.

Materials and Methods

Study area

A cross-sectional, descriptive and analytical study was carried out from February to April 2015. The study took place in three health centre (HC) in the Health District of Dafra at Bobo-Dioulasso and in western part of Burkina Faso (Fig. 1). The population size was estimated at 813,610 inhabitants in 2012. The town has 7 districts and 33 sectors with a southern Sudanese climate and annual rainfall between 900–1200 mm from May to September. The average temperature is 27.5°C (36.5°C in March–April, 19°C from November to February). The health facilities are three: health districts of Dafra and Do and one University Hospital Centre (CHU) [10].

The three study sites were Health and Social Promotion Centres (HSPC) of Guimbi, Bolmakoté and Yéguéresso, which were chosen in order to obtain an exhaustive geographic and socio-economic distributuin of samples. The HSPC of Guimbi is located in the center of the city and has a population of 18,537 inhabitants, including 4,860 women in reproductive age. The HSPC of Bolmakoté is located on the outskirts of the city and serves a population of 22,752 inhabitants, including 5,965 women in reproductive age. The third health center is Yéguéresso located in a rural area with six villages which is an extended health area. The population is estimated at 14,098 inhabitants including women of childbearing age.

Study design and participants recruitment

The study concerned pregnant women of all ages following the pre-natal visits (PNV) at the health facilities of Guimbi, Bolmakoté and Yéguéresso. Women were systematically recruited on the basis of inclusion criteria. Each pregnant woman enrolled, lived in the health zone concerned (Guimbi, Bolmakoté or Yéguéresso) and had given informed and written consent.

Sample size determination

The sample size was estimated according to the procedure of a cross-sectional study. For a prevalence of intestinal parasitic infections of 23.8% and a confidence interval of 95% with a margin of error of 5%, taking into account 10% of lost sight, a minimum size of 270 pregnant women was significant for the study. We included 316 pregnant women with at least 105 pregnant women per site and at least 35 pregnant women by age group of pregnancy.

Sampling and parasitological analysis of stools

During the pre-natal visit, a sterile plastic jar was given to pregnant women to collect the stool. Sampling instructions were given to them to avoid contaminating the samples. The samples were quickly brought to the relevant health facility and then sent to the parasitology and mycology laboratory at Sourou Sanou Hospital within one hour of collection. For better organization, the samples were preferably taken in the morning time.

The stool samples were examined in the laboratory to assess their consistency, the possible presence of blood, mucus, phlegm, pus or parasites visible to the eye. Each sample was observed under the microscope directly and after concentration and staining techniques to look for the different vegetative and cystic protozoan forms as well as helminth eggs and larvae. The enrichment techniques of Ritchie and Willis were used as a method to estimate the concentration. The modified Ziehl Neelsen special staining method was used to search for *Cryptosporidium* sp. oocysts. After each step of processing the sample, the slides were observed under the microscope, starting with a low magnification (×10).

The modified Ziehl Neelsen staining allows the detection of oocysts of *Cryptosporidium* sp., *Isospora belli*, *Cyclospora* sp., and spores of microsporidia. The concentration pellet obtained allowed the preparation of a thin smear which was fixed in methanol for 5 minutes and dried on air. The slides were stained with a carbolic fuchsin solution for 10 minutes. Discoloration with an acid-alcohol solution was done for at least 20 seconds. After rinsing with water, a counterstain was made in a 2% methylene blue solution for 30 seconds. The slides were dried at laboratory temperature and examined under a high magnification optical microscope (×100).

Blood sampling and hemoglobin measurement

Hemoglobin was measured in participants using the HemoCue® device (HemoCue 201, Angelholm, Sweden). The sample was taken by collecting a drop of blood from the tip of finger using a sterile lancet. From a microcuvette, the drop of blood was introduced into the HemoCue device for reading. Anemia was defined in pregnant women by a hemoglobin level below 11 g/dl according to the WHO criteria [6].

Data analysis

The data obtained were entered and processed using the EpiData 3.1 software. Statistical analysis was done with Epi info software version 7.1.4.0. The analysis of risk factors was carried out by logistic regression with a confidence level of 95%. The p-values less than 0.05 were considered statistically significant.

Ethics approval

This study is part of a project whose protocol has been submitted for approval to the institutional ethics committee of the MURAZ Centre. The health authorities of CHUSS region, the health district and health facilities were informed by letters and we

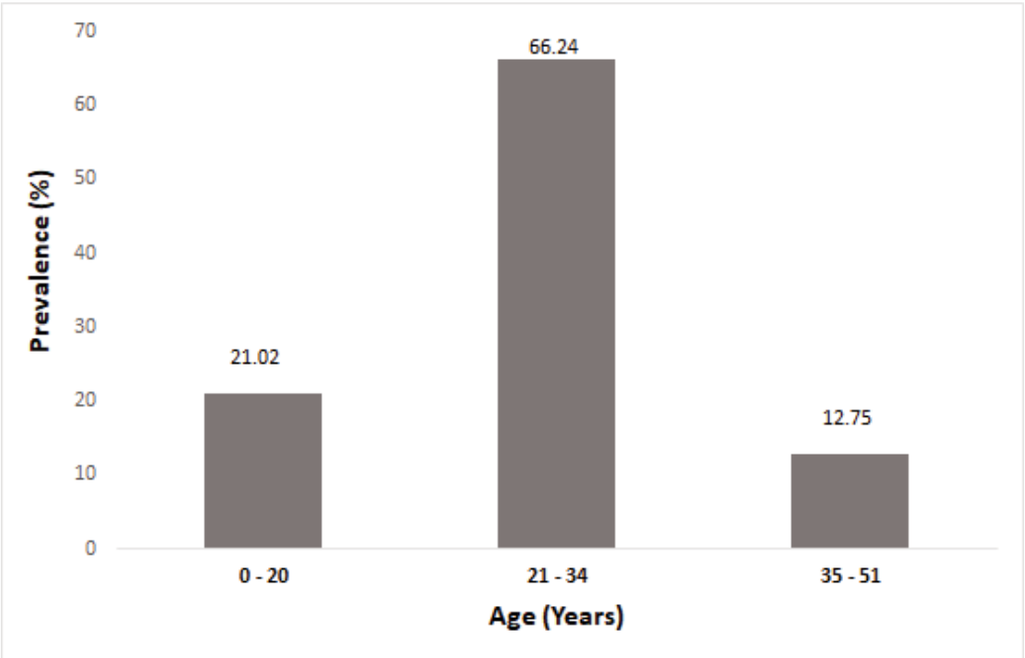

Figure 2. Distribution of pregnant women by age group

received a favorable response. Participants were included after obtaining their informed and written consent. Patients approached could refuse or agree to participate in the study and were free to leave it at any time without prejudice. The data collected had been kept confidential.

Results

Characteristics of the study population

We involved 315 pregnant women with 104, 105 and 106 respectvely at the Guimbi, Bolmakoté and Yéguéresso health centres. The average age of participants was 25.89±5.87 years and ranged from 15 to 49 years range. The most of participants in this study were pregnant women (66.24%) and their age range 21–34 (Fig. 2).

Ninty (90) women (29%) were nulliparous and had never experience of childbirth and 151 women (48.7%) were pauciparous with one or two previous deliveries. Multiparous represented 22.3% (n=69) of patients with more than two previous deliveries. In terms of gestation, 75 women (24.2%) were in their first pregnancy and 235 women (75.8%) were at least in their second pregnancy (Tab. 1).

The majority of participants (83.5%) were housewives and 7.6% were students. Official state numbered 9 (2.9%). According to socioeconomic level, 50% of women (n=157) had an average standard of living according to wage income. Only 16.9% of women (n=53) had a high standard of living and 94.3% (n=50) lived in the centre of the city (Tab. 1).

Prevalence of intestinal parasitoses in pregnant women

Total, 315 stool samples have been subjected to parasitological examination, 210 samples were positive. Then the overall prevalence of intestinal parasitosis in pregnant women was 66.7% [95% CI: 61.1–71.8]. This prevalence was 60.9% (n=64), 69.2% (n=72) and 69.8% (n=74) in Bolmakoté, Guimbi and in Yéguéresso, respectively.

Out of 210 positive samples for intestinal parasitosis, the protozoa were the most isolated with a frequency of 98% (n=206). Helminths were identified in 4 samples (2.0%). Several species of parasites were found in the same stool samples. This poly-parasitism was also observed with the association of helminths and protozoa. *Entamoeba coli* was most isolated protozoan with 54.8% (n=114). This was followed by *Giardia lamblia* found in 51 samples (24.5%) and *Entamoeba histolytica* in 47 samples (22.6%). Other protozoa were less frequently isolated such as *Cryptosporidium* sp. in 38 samples (18.3%), *Trichomonas intestinalis* in 33 samples (15.9%), *Cyclospora* sp. in 20 samples (6.3%) and microsporidia in 15 samples (7.2%). Helminths were found in 4 stool samples with *Hymenolepis nana*, *Strongyloides stercoralis* and *Dicrocoelium* sp. (Tab. 2).

Intestinal opportunistic protozoa parasites were

Table 1. Distribution of pregnant women with their socio-demographic characteristics in the three health Centres

Variables	Characteristics	Health Centers			Total N=315
		Bolmakoté n=105	Guimbi n=104	Yéguéresso n=106	
Trimester of pregnancy (n)	Trimester 1	35	34	11	80 (25.6%)
	Trimester 2	36	35	46	117 (37.5%)
	Trimester 3	34	35	46	115 (36.9%)
Marital status	Married	96 (91.4%)	88 (84.6%)	101 (95.3%)	285 (90.5%)
	Single	9 (8.6%)	16 15.4(%)	5 (4.7%)	30 (9.5%)
Couple lifestyle	Monogamy	85 (88.5%)	80 (90.9%)	72 (69.9%)	237 (82.6%)
	Polygamy	11 (11.5%)	8 (9.1%)	31 (30.1%)	50 (17.4%)
Parity	Minimum	0	0	0	0
	Median	1	1	1	1
	Average	1.6154	1.466	1.3689	1.4839
	Maximum	5	5	6	6
	Nulliparous	29 (27.8%)	28 (27.1%)	33 (32.0%)	90 (29.0%)
	Pauciparous (1-2 previous deliveries)	49 (47.1%)	50 (48.5%)	52 (50.5%)	151 (48.7%)
	Multiparous (>2 previous deliveries)	19 (18.3%)	14 (13.6%)	36 (34.9%)	69 (22.3%)
Gravidity	Minimum	1	1	1	1
	Median	3	3	2	3
	Average	3.1154	2.9126	2.5728	2.8677
	Maximum	7	8	8	8
	Primigravida (first pregnancy)	25 (24.0%)	20 (19.4%)	30 (29.1%)	75 (24.2%)
	Multigravida (≥ 2 pregnancies)	79 (75.96)	83(80.5%)	73 (70.8%)	235 (75.8%)
Profession / occupation	Students	4 (3.8%)	19 (18.3%)	1 (1.0%)	24 (7.6%)
	Officials status	6 (5.7%)	3 (2.9%)	0	9 (2.9%)
	Informal work	11 (10.5%)	8 (7.7%)	0	19(6.0%)
	Housewives	84 (80.0%)	74 (71.1%)	105 (99.0%)	263 (83.5%)
Socioeconomic level(F CFA)	Low (≤500)	16 (15.2%)	0	88 (83.0%)	104 (33.1%)
	Average (500-1000)	88 (83.8%)	53 (51.5%)	16 (15.1%)	157 (50.0%)
	High (≥ 1000)	1 (1.0%)	50 (48.5%)	2 (1.9%)	53 (16.9%)
Level of education	Not literate	39 (37.1%)	24 (23.1%)	64 (60.4%)	127 (40.3%)
	Were literate	6 (5.7%)	6 (5.8%)	10 (9.4%)	22 (7.0%)
	Primary school	34 (32.4%)	29 (27.9%)	26 (24.5%)	89 (28.2%)
	Secondary school	26 (24.8%)	42 (40.4%)	6 (5.7%)	74 (23.5%)
	University level	0	3 (2.9%)	0	3 (1.0%)

found in 70 samples. The prevalence of this was 22.2% (70/315). This prevalence was equivalently distributed in the study areas with 19.0% (20/105) in Bolmakoté, 23.1% (24/104) in Guimbi and 24.5% (26/106) in Yéguéresso.

Prevalence of anemia in pregnant women

Out of the 315 pregnant women, the hemoglobin level less than 11 g/dl was in 41 patients which represented 13% of anemia prevalence. This prevalence was 14.3% (n=15) in Bolmakoté, 8.6%

Table 2. Distribution of parasitic species isolated in stool samples by study area

Isolated parasite species	Study area			Total N=210
	Bolmakoté N=64	Guimbi N=72	Yéguéresso N=74	
Protozoa n (%)	63 (98.4%)	71 (98.6%)	74 (100.0%)	208 (99.0%)
Entamoeba histolytica	12 (19.0%)	20 (28.2%)	15 (20.3%)	47 (22.6%)
Entamoeba coli	39 (61.9%)	35 (49.3%)	40 (54.0%)	114 (54.8%)
Endolimax nana	1 (1.5%)	1 (1.4%)	1 (1.4%)	3 (1.4%)
Enteromonas hominis	2 (3.1%)	3 (4.2%)	3 (4.1%)	8 (3.8%)
Giardia lamblia	19 (30.1%)	11 (15.5%)	21 (28.4%)	51 (24.5%)
Trichomonas intestinalis	11 (17.5%)	11 (15.5%)	11 (14.9%)	33 (15.9%)
Cryptosporidium sp.	9 (14.3%)	11 (15.5%)	18 (24.3%)	38 (18.3%)
Cyclospora sp.	8 (12.7%)	10 (14.1%)	2 (2.7%)	20 (6.3%)
Microsporidia	4 (6.3%)	5 (7.0%)	6 (8.1%)	15 (7.2%)
Helminths n (%)	1 (1.6%)	1 (1.4%)	2 (2.7%)	4 (1.9%)
Hymenolepis nana	0	0	2 (100.0%)	2 (50.0%)
Strongyloides stercoralis	0	1 (100.0%)	0	1 (25.0%)
Dicrocoelium sp.	1 (100.0%)	0	0	1 (25.0%)

(n=9) in Guimbi and 16.0% (n=17) in Yéguéresso.

Risk factors associated with intestinal parasites

We have tested the associations between intestinal parasitic infection in pregnant women and socio-demographic characteristics. We found that there was no significant association between the residence area and the infection (p=0.3). Also, the association between the level of hemoglobin and infection was not statistically significant. However, we found a trend of association between the period of pregnancy occurrence and intestinal parasites in pregnant women. The majority of infected participants had an active pregnancy in the second trimester (prevalence of 72.6%) but this association was not significant (p=0.09). Moreover, the analysis of rests risk factors for parasitic infection showed associations of varying levels, however, none was statistically significant (p>0.05) (Tab. 3).

Discussion

This study aimed to determine the prevalence of intestinal parasitic infections amongst pregnant women resident in different socio-economic areas in Bobo-Dioulasso city. The women were recruited during pre-natal visits to the health centers of our target sites. The identification of intestinal parasites was based on microscopic laboratory examination using concentration and staining techniques on the stool samples. Overall, we found a high prevalence of intestinal parasitic infection (pathogenic and non-pathogenic) of 66.7% [95% CI 61.1–71.8] in 315 pregnant women. The intestinal parasites are still common in the population of pregnant women [2,3,10]. However, in 1993, previous study found in Ivory Coast a prevalence of intestinal parasitosis of 53.5% in 388 pregnant women [7] with the similar result (51.4%) in 2017 in 331 women in the same city [4]. Moreover, studies carried out in the general population of the city of Bobo-Dioulasso had reported high prevalence of intestinal parasitosis [11]. These studies confirmed the endemicity of intestinal parasites in pregnant women in West Africa but their consequence on pregnancy outcome, childbirth and newborn healthy are still unclear. This situation might expose the pregnant women to a negative experience of pregnancy in the city of Bobo-Dioulasso. At the three recruitment sites, the prevalence was 60.9% in Bolmakoté (on the outskirts of the city), 69.2% in Guimbi (in the center of the city) and 69.8% on the Yéguéresso site (in outskirts of the city). However, there was no significant association between the study area and intestinal parasitic infection in pregnant women (p=0.3). This result suggests the interest for

Table 3. Analysis of risk factors associated with intestinal parasites

Variables		No. infected	Prevalence of intestinal parasitosis (%)	*P-value*
Study area	Bolmakoté	66	60.9	0.3
	Guimbi	217	69.2	
	Yegueresso	32	69.8	
Trimester of pregnancy	Trimester 1	80	57.5	0.09
	Trimester 2	117	72.6	
	Trimester 3	115	66.1	
Age (Years)	≤ 20	66	63.6	0.7
	21–34	217	68.2	
	≥ 34	32	62.5	
Marital status	Married	285	67.4	0.5
	Single	30	60.0	
Couple lifestyle	Monogamy	237	66.7	0.8
	Polygamy	50	70.0	
Parity	Nulliparous	90	68.9	0.7
	Pauciparous	151	64.2	
	Multiparous	69	66.7	
Profession	Students	24	66.7	0.2
	Formal work	9	55.6	
	Informal work	19	47.4	
	Housewives	263	68.4	
Socioeconomic level	Low	104	71.1	0.4
	Average	157	63.7	
	High	53	66.8	
Level of education	Not literate	127	70.9	0.2
	Literate	22	72.7	
	Primary school	89	58.4	
	Secondary school	74	66.2	
	University level	3	100	
Hb rate (g/dl)	Hb < 11 (Anemia)	41	61.0	0.5
	Hb ≥ 11	232	67.7	

longitudinal study with mother and child follow-up over certain period of time to look at the consequence of intestinal parasites.

Amongst the parasites infecting pregnant women, *Entamoeba coli* remains the most frequent protozoan (54.8%). This observation had already been made by several authors in the general population [11–13]. This parasite is non-pathogenic, however its pathogenic power is still not well characterized [14]. Our study showed that helminths were present in four samples (1.9%) and were dominated by *Hymenolepis nana* (50%). The low frequency of helminths is due to the systematic deworming strategy with anti-helminthics in Burkina Faso [11]. The decrease in the incidence of helminthiasis revealed the dominance of infection

by protozoa (99%). The implementation of a strategy combining chemoprophylaxis targeting both helminths and protozoa could considerably reduce the incidence of intestinal parasitosis in pregnant women [11,15].

We studied the socio-demographic characteristics of women seen in prenatal consultations and measured the hemoglobin level in order to look for risk factors for intestinal parasitic infection. This study found that infection with intestinal parasites is not significantly associated with the different socio-demographic conditions analyzed (age, trimesters of pregnancy, parity, gestation, professional status and level of education, etc.). The same observation had been made in other previous studies [3,4]. Of the 315 pregnant women examined, 41 had a hemoglobin level below 11 g/dl with a prevalence of anemia of 13.0%. The prevalence of intestinal parasitosis was 61% in these anemic women but this association was not statistically significant (p=0.5). Anemia during pregnancy is frequently associated with malaria and intestinal parasitism [3]. This association is due to the presence of parasitic blood-sucking or hemorrhagic species in humans such as hookworms, roundworms and schistosomes [3,15]. None of these species were found in our study except *Entamoeba histolytica* which is also hematophagous.

Intestinal parasites are still common in pregnant women in Burkina Faso. The presence of parasites during pregnancy has an impact on the positive experience of pregnancy of women with consequences on their offspring. Anthelmintic chemoprophylaxis has been shown to reduce the prevalence of helminthosis. The fact that protozoa are not taken into account in mass deworming is a handicap for the fight against intestinal parasitoses. It would be essential to evaluate the strategies for combating intestinal parasitic infections in pregnant women in Burkina Faso. Co-administration of metronidazole with sulfadoxine-pyrimehamine may reduce the incidence of intestinal parasitoses in pregnant women.

In conclusion, intestinal parasites are still common in pregnant women in Burkina Faso. The presence of parasites during pregnancy has an impact on the positive experience of pregnant women with repercussions on their offspring. Anti-helmintic chemoprophylaxis has been shown to reduce the prevalence of helminthosis. The fact that protozoa are not taken into account in mass deworming is a handicap for the fight against intestinal parasitosis. It would be essential to evaluate the strategies targeting intestinal parasitic infections in pregnant women in Burkina Faso. Co-administration of metronidazole with sulfadoxine-pyrimehamine might reduce the incidence of intestinal parasitoses in vulnerabe and exposed populations.

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