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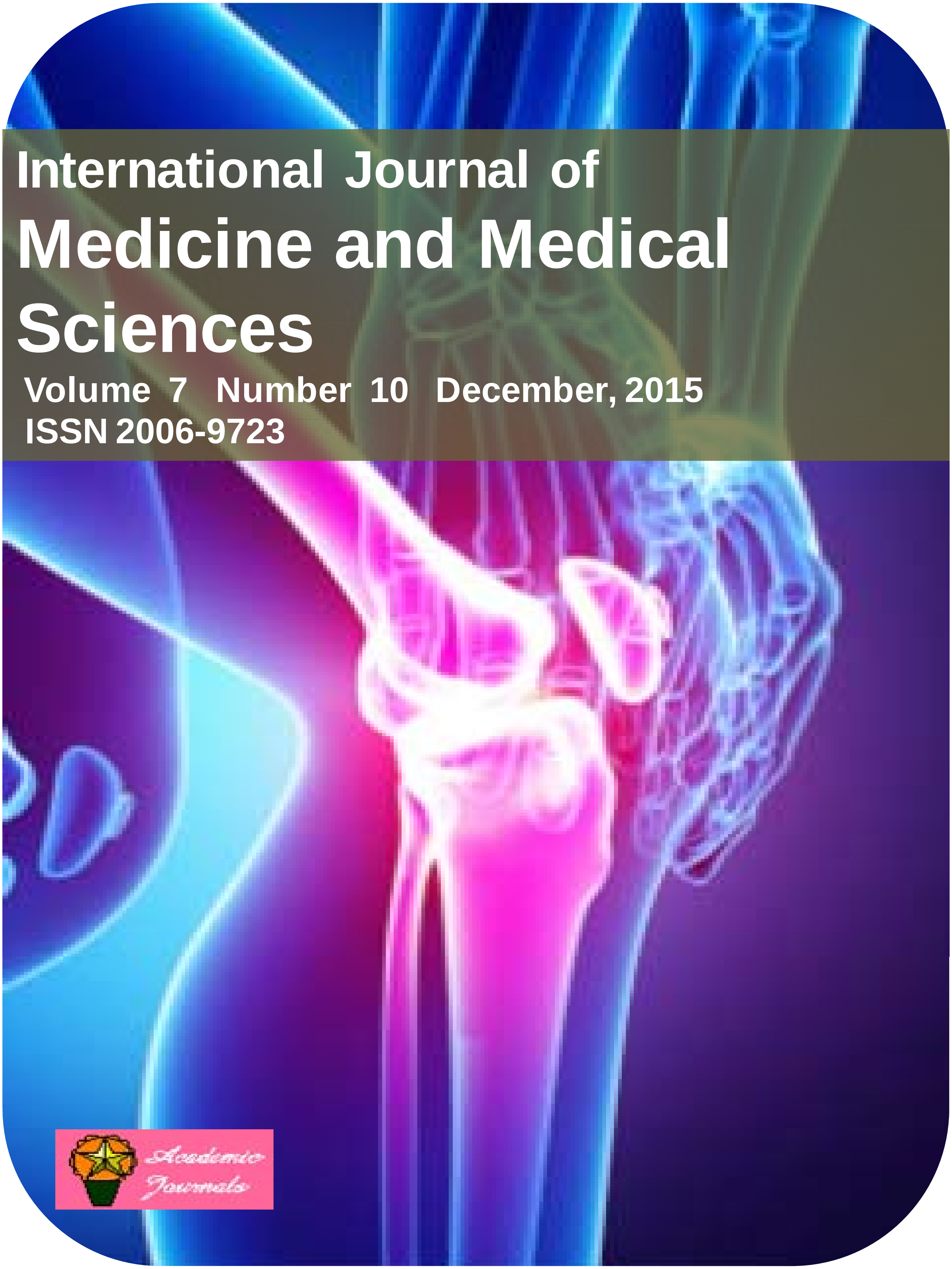

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Full Length Research Paper

Prevalence of *Hymenolepis nana* among primary school children in Burkina Faso

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This cross-sectional descriptive study estimated the prevalence of *Hymenolepis nana* infection in primary school children living in Burkina Faso. A parasitological survey was conducted in 2013 in 22 primary schools located in eleven regions of Burkina Faso. Kato-Katz method was used as a technique to detect the *H. nana* eggs. The prevalence and intensity of the infection were determined by estimating the means of *H. nana* eggs per gram of faeces (epg). 3514 school children from 7 to 11 years old have been investigated. The overall prevalence of *H. nana* was 3.22%. It varied from 0 to 11.25% among the primary schools (p<0.001). The difference was not significant according to gender (p=0.963) and the children aged 8 and 9 years were more infected (p=0.021). The highest mean intensity of eggs was 162 epg according the primary schools. The distribution of *H. nana* in Burkina Faso was determined. The prevalence of *H. nana* was low in the different primary schools.

Key words: Prevalence, *Hymenolepis nana*, school children, Burkina Faso.

INTRODUCTION

Hymenolepis nana is the most prevalent parasite tapeworms (Magalhaes et al., 2013). It is a cosmopolitan parasite by its distribution and it is more prevalent in warm climates (Malheiros et al., 2014). It is endemic in Asia, Africa, Eastern and Southern Europe and Brazil (Huda Thaher, 2012; Malheiros et al., 2014). Infections due to *H. nana* are often asymptomatic when the level of infection is low (Mirdha and Samantray, 2002; Huda Thaher, 2012). But when the level of infection is heavy and chronic, these infections can cause diarrhoea, abdominal pain, headaches and dizziness (Mirdha and Samantray, 2002; Huda Thaher, 2012). Infections due to *H. nana* are associated with low absorption of vitamin B12 in the intestines (Mohammad and Hegazi, 2007).

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Majority of the infections by *H. nana* is by self-infection through contaminated food or water with the eggs contained in faeces. The parasitic diagnosis is based on the detection of *H. nana* eggs in the faeces. There are many stool examination methods (Becker et al., 2011). The formalin-ether-concentration technique (FECT), Merthiolate-Iodure-Formol technique (MIF), Kato-Katz technique, direct analysis, Willis and Ritchie methods, etc., are the techniques for the diagnosis of *H. nana* infection. Among these methods, Kato-Katz technique is the most adapted for the research of helminths eggs (Kremer and Molet, 1975). Moreover, this technique can easily be carried out, and it is advisable for the survey (Montresor et al., 2004). *H. nana* is one of the causal agent of diarrhoea in Burkina Faso (Poda, 2007). It was detected several times in the hospitals (Ouermi et al., 2012; Cissé et al., 2011), and during the studies (Dianou et al., 2004; Poda et al., 2006; Zida et al., 2014; Sangaré et al., 2015). Therefore, the children of school age and adolescents in developing countries are the most exposed. *H. nana* is the most common tapeworm in the world and despite the consequences on the health of schoolchildren it has less attention (Magalhaes Soares et al., 2013). Unlike soil-transmitted helminths and schistosomiasis, there is no specific program against human hymenolepiasis. Burkina Faso started the fight against soil-transmitted helminths and schistosomiasis by treatment with praziquantel and albendazole. These medicines are not completely efficacious against *H. nana* with one dose (King, 2010). To fight against this parasite, it is necessary to do a mapping of the distribution of *H. nana*. This study proposes to initiate this approach in eleven of the thirteen regions that make up the Burkina Faso. This study aims to determine the prevalence of *H. nana* in primary schools in 13 regions of Burkina Faso.

MATERIALS AND METHODS

Study sites

The study was conducted in 22 primary schools located in eleven regions (Figure 1). These sites are the sentinel sites for schistosomiasis and soil-transmitted helminthiasis of the national program of fight against neglected tropical diseases (PNLMTN). These sites were purposefully selected by PNLMTN to monitor the program impact on schistosomiasis.

Study population

The random sampling method was used to select participants in the study after explanation of the aims of the study with school children and their parents. The study population consisted of students from 22 selected schools in 22 villages. The age of the participants ranged from 7 to 11 years in both sexes. In each school, students were selected from the first year to the fourth year of the primary school. In each class, 32 students consisting of 16 girls and 16 boys were selected. Each child received a stool container to collect a stool sample. The stool samples were collected from 8 to 9 am. The samples were brought to laboratory in the cool box. The analysis of stool began 1 h after the collection at 10 am.

Parasitological analysis

The Kato-Katz method (Katz et al., 1972) was used for the detection of *H. nana* eggs in the feces. The stool samples were filtered through a filter and the filtered stool samples were applied to glass slides with spatula and Kato-Katz templates (41.7 mg). The sample on the slide was covered with a cellophane membrane previously impregnated in a malachite green solution for 24 h. Reading was taken using an optical microscope. The number of eggs counted per slide was multiplied by 24 for the intensity of infection in the number of eggs/gram of feces (epg).

Statistical analysis

Data were analyzed by SPSS 20.0 software. The prevalence and confidence intervals (95% CI) were determined. Chi quare test was used to compare the prevalence and $p<0.05$ was considered significant. Mann Whitney test was used to determine the distribution of *H. nana* eggs by sex. This test was used because there were only two variables. Kruskal-Wallis test was used to determine the distribution of the eggs of *H. nana* by region, age and the study sites. The arithmetic mean intensity of infections with standard errors (SE) were determined by taking into account all the participants. A geographical information system (GIS) software Quantum GIS-Valmiera (QGIS 2.2.0 – Valmiera) was used to plot the point prevalence of the infections for each primary school surveyed.

RESULTS

Three thousand five hundred and fourteen students participated in this study. The average age of participants was 9 ± 0.24 years. The overall prevalence of *H. nana* was 3.22% (95% CI: 2.69 - 3.86%). The arithmetic mean intensity of the infection was 38.16 ± 8.96 epg. The highest intensity of the infection was found among students in the Sahel region (128 ± 31.34 epg), North (91.58 ± 78.86 epg) and Centre North (59.70 ± 33.50 epg).

Prevalence and intensity of infection according to the schools

According to the schools surveyed, the prevalence varied from 0 to 11.25% (Table 1 and Figure 1). There are four sites where *H. nana* was not found. The highest prevalence was found at Windou Primary School. The difference in prevalence among schools was statistically significant ($p<0.001$). The Kruskal-Wallis test showed that the distribution of *H. nana* eggs was not uniform ($h<0.001$).

Prevalence and intensity of infection according to the region and gender

The prevalence ranged from 0 to 9.38% by region. The highest prevalence was encountered in the Sahel region. The comparison of prevalence showed that the difference was significant between regions ($p<0.001$) but not by gender ($p = 0.963$). The Mann-Whitney test showed that the distribution of *H. nana* eggs was uniform by gender ($h = 0.963$). The Kruskal-Wallis test showed that the distribution of *H. nana* eggs was not uniform according to region ($h<0.001$). The distribution of prevalence and mean *H. nana* intensity by gender and by region is shown in Table 2.

Prevalence and intensity of infection according to age

The difference of prevalence by age was significant ($p = 0.021$) and

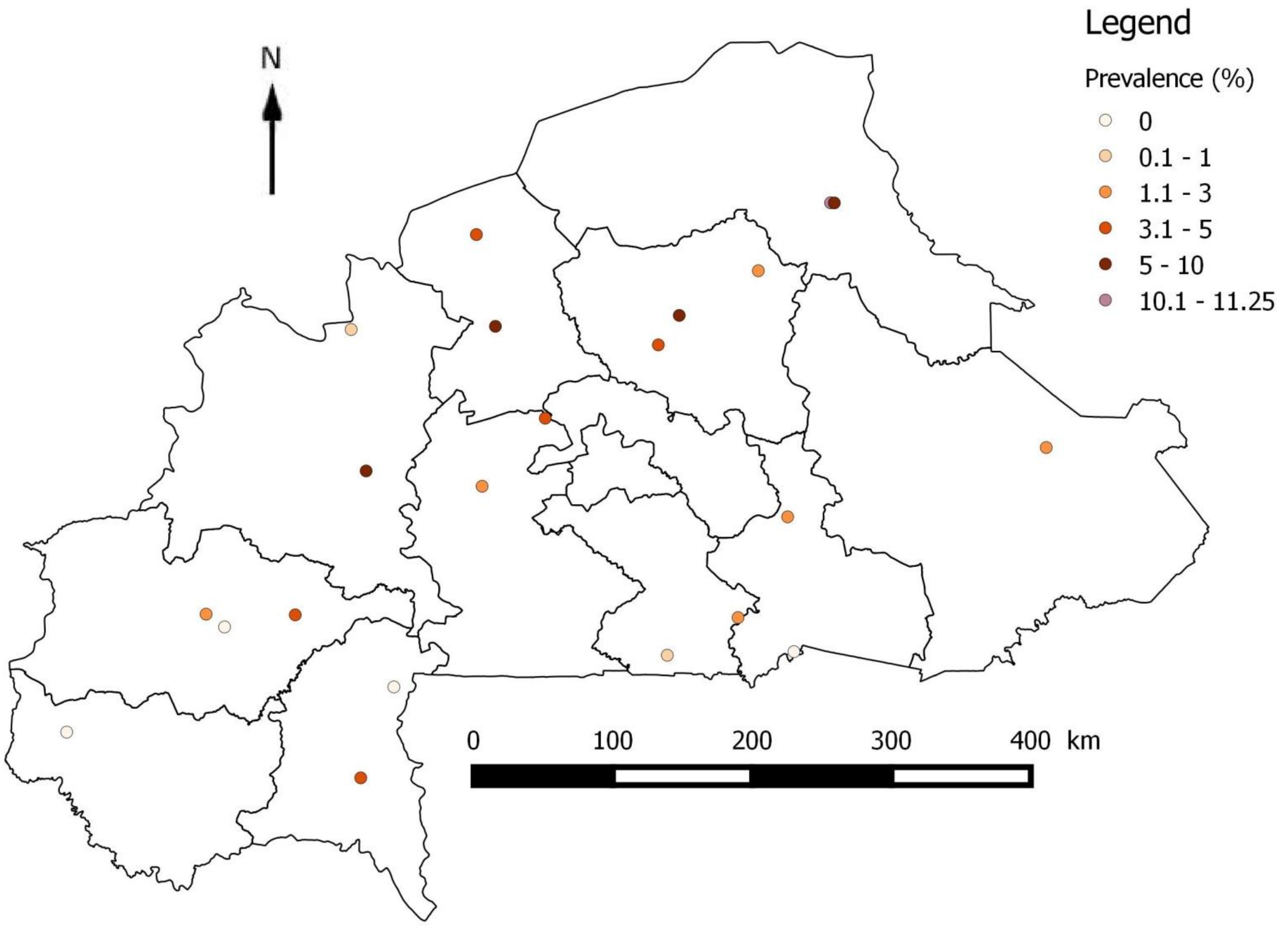

Figure 1. Distribution of prevalence H. nana according to primary schools.

the highest prevalence was among the school children of 7 years old. The Kruskal-Wallis test showed that the distribution of *H. nana* eggs was not uniform according to age (h = 0.02). The distribution of prevalence and mean intensity of *H. nana* infection is shown in Table 3.

DISCUSSION

Poverty is a factor which contributes significantly to the public health problems. In developing countries, there are diseases that are directly related to the lack of properties and hygienic practice. Among the diseases we can cite human hymenolepiasis. Indeed, the prevalence of *H. nana* can be considered an indicator of fecal contamination of environment and hygienic practice in a society (Magalhaes Soares et al., 2013). In our study, the prevalence of *H. nana* infection was 3.22%. But in previous studies conducted in Burkina Faso, the prevalence of *H. nana* was 3.99 to 12.2% (Dianou et al., 2004; Poda et al., 2006; Ouermi et al., 2012). These prevalence rates could be explained by many factors that facilitate transmission of *H. nana* in regions of developing countries such as Burkina Faso. Transmission of *H. nana* is facilitated by the consumption of food contaminated by feces containing *H. nana* eggs. Kpoda et al. (2015) found in Burkina Faso the eggs of *H. nana* in water used for irrigation. The absence of a fountain, the lack of hygiene, and the presence of people already infected with *H. nana* in the concession are factors that contribute to the maintenance of transmission (Mason, 1994; Al-Shammari et al., 2001; Huda Thaher, 2012; Magalhaes Soares et al., 2013; Malheiros et al., 2014). At home overcrowding in concessions is a factor that would increase the risk of contamination of *H. nana* eggs (Magalhaes Soares et al., 2013). Infection of *H. nana* is asymptomatic and according to Mirdha and Samantray (2002), the presence of an infected person in a crowded concession is a contributing factor to its expansion. Contamination may also be in primary schools. In Burkina Faso, there are small markets in primary schools where students buy food. The hygienic conditions are not met in these small businesses (sales places, lack of water for washing hands, absence of hygiene of the sellers). These businesses contribute to maintaining transmission of *H.*

Table 1. Prevalence and intensity of *H. nana* infection according to the sites (primary schools).

Primary school	No. of children examined	Prevalence (%) (95% CI)	Mean of eggs±SE (epg)
Tikan	160	6.25 (3.43 – 11.12)	45.45±22.82
Tiao	160	0.63 (0.11 – 3.46)	0.75±0.75
Nianlé	160	0 (0 – 2.34)	0
Lioulgou	160	1.88 (0.64 – 5.34)	1.35±0.80
Sidogo	160	6.25 (3.43 – 11.12)	26.70±10.89
Tougouri	160	3.75 (1.73 – 7.94)	92.70±66.12
Soala	160	3.75 (1.73 – 7.94)	42.56±23.05
Badongo	160	0.63 (0.11 – 3.46)	0.90±0.90
Mediga	160	1.88 (0.64 – 5.34)	16.03±15.43
Sampieri	154	1.25 (0.34 – 4.44)	1.09±0.78
Douré	160	5.63 (2.99 – 10.35)	172.5±157.60
Koumbri	160	5 (2.56 – 9.56)	10.65±5.52
Kari	160	3.75 (1.73 – 7.94)	60.30±31.20
Panamasso	160	1.88 (0.64 – 5.34)	50.10±48.16
Noumousso	160	0 (0 – 2.34)	0
Windou	160	11.25 (7.24 – 17.08)	169.52±50.76
Dori B	160	7.5 (4.34 -	87.00±36.64
Gora	160	0 (0 – 2.34)	0
Nagbingou	160	2.5 (0.98 – 6.25)	1.18±0.68
Bayandi Palogo	160	2.5 (0.98 – 6.25)	23.40±13.04
Bawan	160	4.38 (2.14 – 8.76)	36.00±23.43
Douna	160	0 (0 – 2.34)	0

Table 2. Prevalence and mean intensity of infection of *H. nana* according to region and gender.

By region	No. of children examined	Prevalence of *H. nana* (%) (95% CI)	Mean of eggs±SE (epg)
Boucle du Mouhoun	320	3.44 (1.93 – 6.05)	23.10±11.47
Centre Est	320	0.94 (0.32 – 2.72)	0.68±0.40
Centre Nord	320	5 (3.10 – 7.97)	59.70±33.50
Centre Ouest	320	3.13 (1.71 – 5.66)	32.98±13.32
Centre Sud	320	1.25 (0.49 – 3.17)	8.47±7.73
Est	314	1.91 (0.88 – 4.1)	1.13±0.51
Nord	320	5.31 (3.34 – 8.34)	91.58±78.86
Hauts Bassins	480	1.88 (0.99 – 3.53)	36.80±19.12
Sahel	320	9.38 (6.65 – 13.07)	128.26±31.34
Sud-Ouest	320	2.19 (1.07 – 4.45)	18±11.74
Cascades	320	0 (0 – 2.34)	0
By gender			
Male	1751	3.2 (2.74 – 4.13)	25.62±7.08
Female	1763	3.23 (0.25 – 4.16)	50.59±16.40

Table 3. Prevalence and intensity of *H. nana* infection according to age.

Age	No. of children examined	Prevalence of *H. nana* (%) (95% CI)	Mean of eggs±SE (epg)
7	704	4.83 (3.48 – 6.67)	52.02±15.66
8	698	3.87 (2.67 – 5.57)	40.52±15.79
9	704	2.56 (1.63 – 4.01)	54.51±37.02
10	704	2.84 (1.85 – 4.35)	38.48±11.61
11	704	1.99 (1.19 – 3.31)	5.28±2.03

nana (Zongo et al., 2006). Indeed, a study in Iran showed that people who ate at the restaurants were the most exposed to intestinal parasites including *H. nana* (Sharif, 2015). In addition, children playing areas are not protected and often encounter animal and/or human feces.

In four sites, the prevalence was zero. This absence of *H. nana* may be due to the method used for this study. Because the Kato-Katz technique is not sensitive when the intensity of infection is low (Knopp et al., 2009; Becker et al., 2011). In our study, the prevalence obtained was low as compared to those obtained in Mexico (Martinez-Barbabosa et al., 2010), in Tajikistan (Matthys et al., 2011), in the East and Northeast of Ethiopia (Tadesse, 2005; Gelaw et al., 2013). The low prevalence may also be explained by the construction of latrines in schools and rural areas in Burkina Faso, the education of hygiene, the use of chemical fertilizers instead of stools in the fields and the countrywide deworming in schools by the various mass treatment programs. Studies have shown that praziquantel could be effective against infections caused by *H. nana* (Rim et al., 1978; Farid et al., 1984). But the praziquantel treatment alone may not be enough, niclosamide should be used together to eradicate *H. nana* in an infected person (King, 2010). When comparing the prevalence by age, it was noticed that the difference was significant ($p = 0.021$), but children of 7 and 8 years old are the most infected. This result could be explained by the fact that at this age, children are not abiding by the hygiene rules and generally they do not wash their hands after using the toilet (Huda Thaher, 2012). Similar studies have shown that children were the most infected (Martinez-Barbabosa et al., 2010; Magalhaes Soares et al., 2013; Malheiros et al., 2014).

Conclusion

This study presented the distribution of *H. nana* among primary schools in Burkina Faso. It helped to know the current situation of *H. nana* infection among students. But it should continue to include other socio-economic factors and extend the investigations to other community members. For now, awareness campaign should be made to school children. The fight against this parasite could be integrated into the control program against neglected tropical diseases.

Conflict of Interests

The authors have not declared any conflict of interests.

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