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Factors associated with intestinal parasites in the central prison of Conakry, Guinea

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Abstract

Introduction: *intestinal parasites are a health issue for communities in developing countries, particularly persons incarcerated in prisons. The purpose of the study was to analyze factors associated with intestinal parasitosis among inmates in the Central Prison of Conakry.* ***Methods:*** *cross-sectional study was carried out between February and July 2017 among inmates of Central prison of Conakry. Demographic and laboratory data on stool samples for intestinal parasites were collected. Logistic regression was used to assess factors associated with intestinal parasites.* ***Results:*** *data from 313 inmates were collected. The overall frequency of intestinal parasites was 33.5% (95% CI = 28.4% -39.0%). Schistosoma mansoni eggs (44.8%) and hookworms' eggs (35.2%) were the most common (44.8%). Factors independently associated with intestinal parasites were lack of education (AOR = 3.35; 95% CI = [1.13-9.95], p = 0.02), primary education (AOR = 3.66; 95% CI = [1.27-10.51]), use of unsanitary toilets (AOR = 0.51; 95% CI = [0.29-0.87]), duration of stay greater than 90 days (AOR = 5.92; 95% CI = [2.23-15.70]) and consumption of tap water (AOR = 0.51; 95% CI = [0.29-0.87]).* ***Conclusion:*** *this study shows that intestinal parasites are very common among inmates of the central prison of Conakry. It is therefore necessary to focus on the cleanliness of the detention facilities, but also to assist in the education of inmates in personal hygiene and the promotion of a healthy diet in order to reduce this phenomenon.*

Introduction

Soil-transmitted helminthiasis (STH) are one of the most common infections in the world and affect the poorest and most deprived communities. It is an infestation with one or more roundworm intestinal parasites that include whipworms, hookworms and roundworms [1]. Globally, approximately 438.9 million people were infected with hookworm in 2010, 819.0 million with *A. lumbricoides* and 464.6 million with *T. trichiura*. Of the 4.98 million years lived with STH disability, 65% were attributable to hookworm, 22% to *A. lumbricoides* and the remaining 13% for *T. trichiura*. The vast majority of infections STH (67%) and young people (68%) occurred in Asia [2]. These statistics have increased to 2 billion people worldwide. Thus, in 2012 the WHO estimated that more than 1 billion people were infected with *A. lumbricoides*, 795 million with *T. trichiura* and 740 million with hookworms *(Ancylostoma duodenale and Necator americanus)* and the most affected areas were sub-Saharan Africa, the Americas, China and East Asia [3]. There are similarities between health care in the community and in prisons, but there are also differences. The prison leads to loss of freedom that has many consequences on inmates of healthcare. The prison environment often poses a threat to well-being, including decision-making capacity, and to a sense of personal safety [4]. Several research studies point out that the eco-climatic conditions, geo-locality, socio-economic, environmental, behavioural, cultural and demographic factors (particularly age) influence the prevalence of infectious diseases and infection with different types of intestinal parasites [5-9].

The health and socio-economic implications associated with intestinal helminths are enormous particularly in rural communities in developing countries where malnutrition favours transmission of infection [10]. However, since many infectious parasites especially those caused due to helminths, are usually asymptomatic, they are often overlooked until the onset of severe or chronic clinical complications. Outside the community,

intestinal parasites are increasingly prevalent in prisons where crowding and environmental conditions are inappropriate. In most prisons in developing countries, health care depends on underfunded systems, due to poor structural planning and investment, but also to poorly trained health professionals [11]. In sub-Saharan, studies in various prisons, including Ouagadougou Central Prison in Burkina Faso and Jos prison in Nigeria, have revealed high frequencies of intestinal parasites among inmates [12,13]. Guinea, like other countries in sub-Saharan Africa, is not immune to this phenomenon of intestinal helminthiasis. Also, given the deplorable hygienic conditions in prisons in Guinea, particularly in the Central prison of Conakry, and the scarcity of available data and previous studies on parasitosis in Guinean prisons, it was necessary to conduct this study. The aim was to estimate the frequency and analyze the factors associated with intestinal parasites among inmates of the central prison of Conakry.

Methods

Study design: this was a cross sectional study referred involving inmates of the central home of Conakry, from whom stool samples were collected during the period from February to July, 2017.

Setting: the central prison of Conakry served as the setting for our study. It was built in 1930 during the colonial period with a capacity of three hundred (300) inmates. In our time, it hosts more than 1,500 inmates and it is the largest penitentiary detention center in Guinea. Its purpose is detention and socio-professional reintegration. It´s located in Conakry exactly at the center area of Kaloum and the heart of Coronthie district. It is under the supervision of the Ministry of Justice and has no maintenance staff. The sanitation of the premises and the provision of materials necessary for the hygiene and washing of inmates are the responsibility to them self. The infirmary is located in a large room with two offices: that of the head doctor and the second occupied by the nurses. There is also a multi-purpose treatment room equipped with two beds, a table and three cupboards for storing medicines and an internal toilet, consultations are made on request of inmates.

Study participants: the study focused on prisoners residing in the different compartments (children's, men's and women's detention areas) of Conakry Central Prison, who gave their free consent and for whom stool samples were taken during the collection.

Study size: the sample size of prisoners was calculated by the Schwartz formula using a proportion of 71.5% obtained after the pre-test phase, a precision of 5% and an alpha risk of 5%. The source population consisted of 1,500 prisoners during the study period. The sample size obtained was 313 inmates. Participants were prospectively selected during regular visits to the central prison infirmary.

Data collection: the data collection followed a contact with the authorities of the central prison of Conakry, an information and sensitization of the inmates on the objectives and benefits of the study in common agreement with the prison authority. Then, data were collected using a standardized questionnaire including information on socio-demographic characteristics (age, gender, level of education, state of latrines, quality of drinking water, length of detention), information on macroscopic and microscopic examinations of inmates´ stools. The collection and analysis of stools was possible with the help of materials (optical microscope, plastic stick, empty penicillin bottle, object holder, object cover slide, rinsing container, non-sterile gloves, Pasteur pipette, grease pencil marker) and reagents (physiological serum, Lugol´s solution, Willis´ solution) from the laboratory. Stool´s macroscopy was essential for the characteristics and detention of some adult parasites (pinworms, roundworms, tapeworm rings), identification of color, consistency of stool. And it constituted an element of orientation of microscopic examination (Glaire, mucositis). Each stool examination was subject to: a fresh

macroscopic examination (appearance, colour, consistency, presence of blood, mucus or slime and possible presence of Tænia rings and adult worms); fresh microscopic examination in physiological water and Lugol´s; of an enrichment by the Willis method.

Statistical analysis: proportions were calculated for qualitative variables. Quantitative variables were expressed as mean ± standard deviation and median with interquartile ranges. Univariate and multivariate logistic regressions were used to search for factors associated with intestinal parasites. Only variables with a p-value less than or equal to 0.20 in the univariate analysis were included in the multivariate analysis. Age-adjusted multivariate regression analysis with a top-down stepwise method was used to select the best model. The significance level was set at p <0.05. Epi Data 3.1 was used for data entry and SPSS 21 "Statistical Package for the Social Sciences" for statistical analysis.

Ethical considerations: the study protocol was submitted for approval to the research project review and validation committee of the Chair of . of the Faculty of Health Sciences and Techniques of the Gamal Abdel Nasser University in Conakry. The data were collected after obtaining permission from the prison administration of the central prison of Conakry. All information and data collected during this study was done in strict compliance with ethical rules. Verbal consent was obtained from each study participant prior to the administration of the form and receipt of the stool samples.

Results

Inmates demographics information´s: Table 1 describes the socio-demographic characteristics of the inmates. The median age of the sample was 24 years with interquartile ranges of 19 and 33 years. Men represented 86% of the inmates. Slightly more than half (56.2%) of the inmates had attained an educational level beyond primary school. Most (73.1%) of respondents resided in the adults´ areas. The state of cleanliness of latrines was not good (78.9%) overall. Most of the inmates use tap water (62.3%) but also borehole water (34.8%). Slightly more than two thirds of the inmates had been held in cells for more than ninety (90) days.

Prevalence of intestinal parasites among prisoners: the results of the stool analysis showed that the frequency of intestinal parasites was 33.5% (95% CI = 28.4%-39.0%).

Parasitological characteristics of stools: Table 2 describes the status and results of stool parasitology of inmates. Analysis of the stool samples collected showed that they were in mostly of soft consistency (73.5%). Also, the stools had a normal appearance (98.1%) overall. In the fresh state, *Schistosoma mansoni* eggs were the most frequent (44.8%) followed by hookworm eggs (35.2%), roundworm eggs (8.6%) and anguillid larvae (6.7%).

Factors associated with intestinal parasites: the results of the univariate and multivariate regression are presented in Table 3. The univariate analysis shows that age (OR = 0.94; 95% CI [0.94-0.99], p = 0.007) reduces the probability of having intestinal parasite among inmates by 4%. Inmates with primary education 0(OR = 5.68, 95% CI = [2.13 to 15.09]; p <0.001) and those with no education (OR = 3.95; 95% CI = [1, 45 to 10.72]; p = 0.007) were 5.7 and 4 times more likely to develop intestinal parasites respectively. Depending on the detention area, minors were about 4 times more likely to develop intestinal parasites during their stay (OR = 3.80; 95% CI = [1.52 to 9.53]; p = 0.004). Inmates who used unclean (OR = 2.05, 95% CI = [1.03 to 4.06], p = 0.03) and unsanitary latrines (OR = 3.28, 95% CI = [1.52 -7.06], p = 0, 002) were two and three times more likely to develop intestinal parasites, respectively. Drinking tap water of would reduce the occurrence of intestinal parasites infections among inmates (OR = 0.39, 95% CI = [0.24 to 0.64], p <0.001) by 61%. However, inmates who drank borehole water were two (2) times more likely to develop intestinal parasites (OR = 2.29, 95% CI = [1.41 to 3.73], p = 0.001). Regarding the

length of detention, inmates who had stayed more than 90 days were three (3) times more likely to have intestinal parasites. It should be noted that there was a marginal association between well water consumption and intestinal parasites.

In multivariate analysis (Table 3), the results obtained show that inmates who had a primary level of education (AOR = 3.66, 95% CI = [1.27 to 10.51], p = 0.01) and no level of education (AOR = 3.35, 95% CI = [1.13 to 9.95], p = 0.02) were respectively three (3) and four (4) times more likely to have intestinal parasites. Those who used the toilet that was unsanitary were four (4) times more likely to have intestinal parasites. In addition, drinking tap water (OR = 0.51, 95% CI = [0.29 to 0.87], p = 0.01) during the cell stay would reduce the likelihood of developing of intestinal parasites infections by 49%. The results also show that inmates who had a detention period of more than 90 days (OR = 5.92, 95% CI = [2.23 to 15.70], p<0.001) were about six (6) times more likely to develop intestinal parasites.

Discussion

The aim of this study was to estimate the frequency and analyze the factors associated with intestinal parasites among inmates of the central prison of Conakry. This study is one of the first to address this issue in a prison environment in the Republic of Guinea. The results showed that 33.5% of inmates had intestinal parasites. In a study, authors reported a prevalence of 71.5% among inmates in the Ouagadougou Prison [13]. In Nigeria, prevalences of 9% and 77% were found among prisoners in Jos [12] and Owerri [14], respectively. In Ethiopia, researchers found prevalences of 47.4% and 61.8% respectively in Bedele (Southeast) [15] and SheaRobit (North Central) [16] prisons. In Kenya, the authors found a prevalence of 24.7% among inmates in Kisii prison [17]. In Brazil, other authors reported a prevalence of 20.2% among prisoners in Campo Grande prison, capital of Mato Grosso do Sul [11]. This relatively high prevalence in our study would indicate the sometimes poor conditions of detention, the insufficient sanitation of the communal latrines, the difficulty of ensuring effective hygiene, the lack of knowledge of and non-compliance with hygiene rules by inmates, the consumption of untreated water, but also the fact the inmates come from dwellings with probably precarious living conditions. Similarly, these differences in proportions observed can be explained either by sample sizes but also by the parasitological examination techniques used in each of these studies.

Parasitological examinations showed that the dominant parasites were helminths, namely *Schistosoma mansoni* and hookworm. These results are different from those found in a study in Ouagadougou in 2010 where the most common parasites were dominated by amoebae (*Entamoeba coli and Entamoeba hystolitica*) and flagellates (*Trichomonas intestinalis and Giarda intestinalis*) [13]. Other authors reported a predominance of *Giardia lamblia* [11]. In addition, authors found in Ethiopia, a predominance of *Ascaris lumbricoides* and hookworm [16]. The results of the multivariate analysis showed that the lack of education, primary school education, use of unsanitary toilets, the length of stay over 90 days were likely to be factors independently associated with the occurrence of intestinal parasitic infections among inmates. In addition, consumption of tap water would be a protective factor for the presence of intestinal parasites among inmates. A study in Kenya found that washing hands before eating and after visiting the toilet, and wearing shoes reduce the risk of contracting intestinal parasites, while being men and in the 20-29 age group increased the risk of intestinal parasitosis [17]. Other researchers reported that uncut fingernails were associated with *Ascaris lumbricoides* infection in prisoners in a prison in Southwestern Ethiopia [16]. In north-central Ethiopia, authors reported that lack of previous treatment for intestinal parasites was a risk factor for intestinal parasites [15]. These differences in reported risk factors could be

explained by the geographical location of prison populations.

This study appears to have some limitations. First, the negative stool parasitology results were not subjected to another confirmatory method of analysis. We were unable to measure polyparasitism in the inmates. Second, the frequency obtained from a pretest for sample size calculation appears to be overestimated. This study was conducted in a single prison and the results obtained cannot be generalized to all eight central prisons in Guinea. However, the study has helped to fill a knowledge gap on the issue of intestinal parasites in prison in Conakry by estimating the prevalence of intestinal parasites and identifying the factors on which it would be appropriate to act for better prevention and health of people incarcerated in prisons. Also, to our knowledge, this study would be the first of its kind in Guinea in a context where little data on this problem is available.

Conclusion

In conclusion, this study shows that the prevalence of intestinal parasites is high among inmates at the Conakry central prison. Inmates with no education, primary education, using unsanitary toilets and whose detention period exceeded 90 days were at higher risk of contracting intestinal parasites. Those who drank tap water were at lower risk of intestinal parasites. It would be appropriate to focus on the cleanliness of the detention facilities, but also to assist in the education of inmates in personal hygiene and the promotion of a healthy diet in order to reduce this phenomenon.

What is known about this topic

- *Intestinal parasites are common among prisoners;*
- *Intestinal parasites are more common in prisons with overcrowding and inadequate conditions of detention.*

What this study adds

- *This study is the first to look at parasitic diseases among inmates in the central prison of Conakry;*
- *Frequency of intestinal parasites is very high in the central prison of Conakry;*
- *A long period of detention would increase the risk of developing intestinal parasites among inmates.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Kadio Jean-Jacques Olivier Kadio and Awo Laurent Abro designed the study. Kadio Jean-Jacques Olivier Kadio, Awa Laurent Abro, Diao Cissé and Adrien Fapeingou Tounkara analysed the field data. Kadio Jean-Jacques Olivier Kadio drafted the paper, Awo Laurent Abro and Diao Cissé reviewed the draft and made some changes. All the authors have read and agreed to the final manuscript.

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Table

Table 1: socio-demographic characteristics and living conditions of inmates stool in Conakry Central Prison, Guinea, February-July, 2017

Table 2: status and results of stool parasitology of inmates stools in the central prison of Conakry, Guinea, February-July, 2017

Table 3: univariate and multivariate analysis of factors associated with intestinal parasites among inmates of the central prison of Conakry, Guinea, February-July, 2017

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Table 1: socio-demographic characteristics and living conditions of inmates in Conakry central prison, Guinea, February-July, 2017

Variables	**Number**	**Percentage (%)**
Sex		
Male	269	85.9
Female	44	14.1
Median age in years (IQR)	24 (19-33)	
Level of study		
No level	64	20.4
Primary	73	23.3
Secondary	133	42.5
Superior	43	13.7
Detention unit (HQ)		
Juvenile HQ	44	14.1
Men´s HQ	229	73.1
Women´s HQ	40	12.8
State ownership of latrines		
Perfect	85	20.8
Not very clean	177	56.5
Unsanitary	71	22.7
Water consumption		
Tap	195	62.3
Drilling	109	34.8
Well	7	2.2
Mineral water	19	6.1
Duration of detention (in months)		
Median (IQR)	7 (3-12)	
≤ 30	43	13.7
31-90	45	14.4
> 90	225	71.9

Table 2: status and results of stool parasitology of inmates stools in the central prison of Conakry, Guinea, February-July, 2017		
Variables		**Percentage (%)**
Stool consistency		
Solid	23	7.3
Liquid	13	4.2
Soft	230	73.5
Paste	47	15.0
Stool appearance		
Glairo-sanguinolent	6	1.9
Normal	307	98.1
Parasitosis		
Positive	105	33.5
Negative	208	66.5
Types of parasites		
Hookworm egg	37	35.2
S. mansoni egg	47	44.8
Anguillula larvae	7	6.7
Taenia egg	1	1.0
Amoeba cyst	2	1.9
Whipworm egg	2	1.9
Ascaris egg	9	8.6
Lugol´s method		
Positive	101	32.3
Negative	212	67.7

Table 3: univariate and multivariate analysis of factors associated with intestinal parasites among inmates of the central prison of Conakry, Guinea, February-July, 2017

Variables	**Univariate**		**Multivariate**	
	CrudeOR (95% CI)	p-value	AdjustedOR (95% CI)	p-value
Sex				
Male	1.4 [0.69-2.86]	0.34	-	-
Female	1	-		
Median age (continuous)	0.96 [0.94-0.99]	0.007	-	-
Level of study				
No level	3.95 [1.45-10.72]	0,007	3.35 [1.13-9.95]	0.02
Primary	5.68 [2.13-15.09]	<0.001	3.66 [1.27-10.51]	0.01
Secondary	2.55 [1.00-6.54]	0.05	1.91 [0.71-5.12]	0.19
Superior	1	-	1	-
Detention Unit (HQ)				
Juvenile HQ	3.80 [1.52-9.53]	0.004	1.20 [0.30-4.79]	0.79
Men´s HQ	1.11 [0.52-2.35]	0.77	0.38 [0.11-1.32]	0.13
Women´s HQ	1	-	1	-
State of ownership of latrines				
Perfect	1	-	1	-
Not very clean	2.05 [1.03-4.06]	0.03	2.91 [0.98-8.61]	0.05
Unsanitary	3.28 [1.52-7.06]	0.002	4.25 [1.30-13.84]	0.01
Water consumption				
Tap	0.39 [0.24-0.64]	<0.001	0.51 [0.29-0.87]	0.01
Drilling	2.29 [1.41-3.73]	0.001	-	-
Well	5.15 [0.98-27.00]	0.05	-	-
Mineral water	0.51 [0.16-1.57]	0.24	-	-
Stool consistency				
Solid	1	-	-	-
Liquid	0.48 [0.11-2.03]	0.32	-	-
Soft	0.56 [0.23-1.32]	0.18	-	-
Paste	0.37 [0.13-1.06]	0.06	-	-
Stool appearance				
Glairo-sanguinolent	0.99 [0.17-5.49]	0.99	-	-
Normal	1	-	-	-
Length of detention (days)				
≤ 30	1	-	1	-
31-90	1.46 [0.50-4.29]	0.48	2.12 [0.66-6.82]	0.20
> 90	3.30 [1.40-7.75]	0.006	5.92 [2.23-15.70]	<0.001