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ORIGINAL ARTICLE

Prevalence and intensity of intestinal helminthiasis in children living in orphanages in Benin City, Nigeria

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Key words

Helminthiasis • Intensity • Orphans

Summary

Background. *Orphans may be envisaged to have sub-optimal care and may be predisposed to high worm burden. This study was undertaken to determine prevalence and intensity of intestinal helminthiasis in children living in orphanages in Benin City, Nigeria.*
Methods. *Fresh stool samples from 150 children (0-17 years) living in 10 orphanages in Benin City, were analyzed using the Kato-Katz technique for the detection of ova of helminths between January and April, 2011.*
Results. *The subjects consisted of 62 (41.3%) males and 88 (58.7%) females; mean age (± standard deviation SD) 7.0 ± 4.6 years, and mean (± SD) years lived in the orphanage was 4.0 ± 3.7 years. Prevalence of intestinal helminthiasis was 20.7% and this prevalence was highest in children ages 12-17 years, children who had lived longer years in the orphanages and in orphanages with poor child/care-giver ratio (orphanage F = 12.0: 1 and orphanage H = 7.3: 1). Mean (± SD) age (8.7 ± 4.5 years) of infected subjects was significantly higher than (6.6 ± 4.5 years) observed in non-infected subjects (p = 0.023). Ascaris lumbricoides and Trichuris trichiura were the intestinal helminths isolated. Intensity of intestinal helminths was light in 24/31 (77.4%) and moderate in 7/31 (22.6%) infected subjects. Median egg per gram was 999 eggs per gram and range was 48-8000.*
Conclusion. *Improved child/care-giver ratio in orphanages will reduce worm burden in orphanages in Benin City.*

Introduction

The World Health Organization (WHO) estimates that over one billion of the world's population is chronically infected by intestinal helminths.[1] Pre-school and school children are at higher risk of heavy helminths burden [1, 2]. In Nigeria, there are varying prevalence of intestinal helminthiasis ranging from 14.4%-71.1% depending on geographic region and methods employed in the epidemiological study [2].
Sub-optimal care, poor environmental sanitation, personal hygiene, lack of potable drinking water, and inadequate health care which characterize most communities in developing countries including Nigeria are major contributors to increased worm burden [1, 2].
A child is termed an orphan when the child loses either or both parents by death or when the child has been abandoned by his/her parents and his/her parent(s) whereabouts cannot be ascertained [3]. In Nigeria, a rapid assessment of orphans and vulnerable children conducted in 2004 by United Nations Children Fund (UNICEF) support group revealed that there was an estimated seven millions orphans in 2003; 1.8 million of whom were orphaned by Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) [4]. The number of orphans in Nigeria was estimated at 8.2 million by the end of 2010 [1, 2]. With the increased burden of poverty, families and communities could no longer cope with an increased number of orphans.
The negative impact of this degree of orphanhood on the society is evident through the growing number of children living within the orphanages [3]. This results to overcrowding, poor child to caregiver ratio in orphanages translating to sub-optimal care of these children, and inadequate facilities within the orphanages. These children are at higher risk of infections including intestinal helminthiasis and hence there is need to protect them [1, 4-7].
There is paucity of data on prevalence of intestinal helminthiasis in children living in orphanages in Nigeria. Ogbe et al. observed a prevalence of 63.6% in one orphanage in Lagos, South-West Nigeria over a decade ago (in 1990) [7]. There is need for an epidemiological survey of intestinal helminthiasis involving several orphanages.
This study was to identify prevalence and intensity of intestinal helminthiasis in children (0-17 years) living in orphanages in Benin City, South-South Nigeria. Findings from this study will identify the burden or otherwise of intestinal helminthiasis in children living in orphanages and could serve as basis for interventional programs for these children and the entire population.

Subjects and methods

This was a cross sectional, descriptive study and was carried out between January and April 2011.
Benin City is capital of Edo State located in South-South geopolitical region of Nigeria, and lies within the rain forest belt at 122 meters above sea level and has a total

population of 1,085,676 [8]. The City is predominantly an urban setting and the inhabitants are mainly civil servants, traders and peasant farmers.

Ethical approval was obtained from the Ethics and Research Committee University of Benin Teaching Hospital, Benin City, Nigeria. In addition, a written permission was obtained from the Ministry of Women Affairs and Social Development, Edo State Nigeria and a written informed consent from the proprietors/proprietresses of the selected orphanages.

There were 15 registered orphanages located in different parts of Benin City. The orphanages are privately owned by individuals or corporate bodies. Five of the orphanages were excluded in the study for the following reasons: three were not functional as the time of the study; one of the orphanages had no child as inmate during the period of recruitment of the subjects and one of the orphanages with 8 inmates was used for pre-testing and so was excluded from the final analysis. Ten of the orphanages were then used for this study. These 10 orphanages had a total of 165 inmates. Six of the inmates were 18 years and above and were excluded from this study. Of the 159 children seen in the orphanages, 150 children had complete data and submitted appropriate stool samples for analysis giving a response rate of 94.3%.

Preliminary meetings were held with the proprietors/ proprietresses of the selected orphanages where the outline of the programme was explained in details. A written informed consent was signed by care-givers' of each child and an assent obtained from older children participating in the study.

During recruitment of participants, the procedure of stool collection with a wooden stick was clearly explained to the older children and the caregivers within the orphanages. Each child within the orphanage was given an identification number. Stool containers labeled with each child's identification number were given to the caregivers within each orphanage previous day. Morning stool samples were preferred for analysis,[9] and the researcher and researcher assistants were at the orphanages in the morning to collect the stool samples.

Stool sample collected in the mornings from each subjects was examined the same day with the Kato-Katz method to quantitate the number of eggs per gram of feaces (WHO 1998) [9] in Research Laboratory, Department of Child Health, University of Benin Teaching Hospital, Benin City. In order to ensure proper identification of hookworm ova, the preparation of each stool slide was read not later than 4-6 hours after taking the samples.[9,10] All the slides were read by one medical microbiologist specialized in parasitology while consistency of the readings was assured by second readings performed in 20.0% of the slides randomly selected. Another reading was done after 24 hours for search for ova of *Schistosoma mansoni* [9, 10]. Intensity of infections for each worm was defined according to the thresholds proposed by the WHO Expert Committee in 1987 [10].

Data analysis

The data obtained was entered into a spread sheet using the Microsoft Excel 2007 and the analysis was done using the Statistical Package for Scientific Solutions (SPSS) version 13.0 (SPSS Inc Chicago, Illinois, USA). The overall prevalence, specie-specific prevalence, and intensity of intestinal helminths in subjects were calculated and comparison was made between infected and non-infected subjects. Quantitative variables were summarized using means and standard deviations. The significance of association between variables was tested using chi-square and Fisher's exact tests where appropriate while student t-test was used for comparison of means. The level of significance of each test was set at $p < 0.05$.

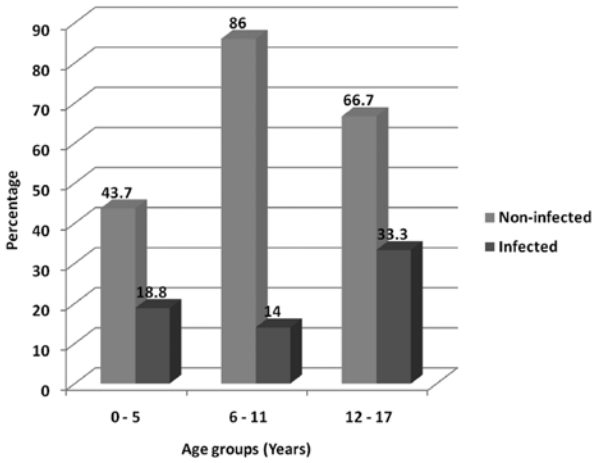
Results

The subjects consisted of 62 (41.3%) males and 88 (58.7%) females; mean age (± standard deviation SD) 7.0 ± 4.6 years, and mean (± SD) years lived in the or-

Tab. I. Age and gender distribution of the subjects.

Age (Years)	Male (%)	Female (%)	Total (%)
0-5	23 (37.1)	41 (46.6)	64 (42.7)
6-11	18 (29.0)	32 (36.4)	50 (33.3)
12-17	21 (33.9)	15 (17.0)	36 (24.0)
Total	62 (100.0)	88 (100.0)	150 (100.0)
Educational status			
Nursery	8 (13.0)	17 (19.3)	25 (16.7)
Primary	34 (54.8)	34 (38.6)	68 (45.3)
Secondary	3 (4.8)	6 (6.8)	9 (6.0)
Vocational school	0 (0.0)	1 (1.1)	1 (0.6)
Under age	14 (22.6)	23 (26.1)	37 (24.7)
Not in school	3 (4.8)	7 (8.0)	10 (6.7)
Total	62 (100.0)	88 (100.0)	150 (100.0)

Fig. 1. Age group specific prevalence of intestinal helminthiasis among the subjects.



phanage was 4.0 ± 3.7 years. Table I shows the age distribution and educational status of the subjects by gender. All the children who were in school attended privately owned nursery, primary and secondary schools. Thirty-seven children were under age for school attendance. Of the 10 that were not in school, there were no funds to send 2 of them to school and 7 of these children were obviously physically challenges and were not yet enrolled into any special or vocational schools. Sources for material resources/fund for all the orphanages were by donors. All the proprietors/proprietress of all the orphanages attended University education or its equivalent. Each of the orphanages had a borehole which serves as source of drinking water for all inmates. There was presence of at least one toilet (water cistern) in each orphanage for the inmates and another toilet (water cistern) for the staff of the orphanage. Each toilet had flowing water from the borehole and had at least a tablet of toilet soap for hand washing.

Thirty-one (20.7%) of the 150 children seen within the orphanages were infected with intestinal helminthiasis.

Mean (± SD) age (8.7 ± 4.5 years) of infected subjects was significantly higher than (6.6 ± 4.5 years) observed in non-infected subjects (t = 2.30, p = 0.023, 95% confidence interval (CI) = 0.91, 0.29). Figure 1 shows age specific prevalence of intestinal helminthiasis among the subjects. Prevalence of intestinal helminthiasis was highest within age group 12-17 years (33.3%). Though there was no significant difference in mean duration lived in the orphanages among the infected and non-infected children but most infected children had lived longer within the orphanage.

Table II shows age and gender distribution among infected and non-infected subjects. Though there was no significant gender difference in helminthic infection between girls: 17/31 (54.8%) and boys: 14/31 (45.2%) ($\chi^2 = 0.08$, p = 0.78, OR = 1.2), but there was an increase in prevalence with increasing age in boys. Girls were more affected than boys at early ages (0-5 years and 6-11 years respectively), but with a decline in prevalence of helminthic infections at ages 12-17 years.

Species of intestinal helminths isolated were *A. lumbricoides* in 28/31 (90.3%) and *T. trichiura* in 3/31 (9.7%) of subjects. Table III shows species of intestinal helminths according to gender and age distribution. All the infected boys had *A. lumbricoides*, while 82.4% of the girls had *A. lumbricoides* and 17.6% of the girls had *T. trichiura*. All species of *T. trichiura* were observed only in girls. Prevalence of *A. lumbricoides* species tend to remain high within all the age groups compared to *T. trichiura* species which tend to be low or absent at increased age (12-17 years).

Prevalence of intestinal helminthiasis in subjects according to the orphanages is shown in Table IV. The 31 infected subjects were drawn from 6 orphanages A, B, C, F, H and J. Prevalence of intestinal helminthiasis was highest in orphanage F (50.0%), followed by orphanage H (40.9%). In these orphanages, the child/caregiver ratio was poor (orphanage F = 12.0: 1, orphanage H = 7.3: 1).

The intensity of intestinal helminthic infection was light in 24/31 (77.4%) and moderate in 7/31 (22.6%). Moderate intensity of intestinal helminthic infections was observed highest in orphanage F where 50.0% of the infected subjects had moderate intensity of infection, followed by orphanage A (25.0%), then orphanages H (22.2%), and C (17.7%). No heavy intensity and mixed infections were observed in any of the orphanages in this study. Eggs per gram range among the infected subjects were 48-8000, and median egg per gram was 999 eggs per gram.

One hundred and forty-five (96.7%) received anthelminthic drugs at least once in the last one year. Table V shows frequency of de-worming exercise in the orphanages in the last one year. Most of the children in the orphanages received anthelminthic drugs every 3-6 months.

Tab. II. Age and gender distribution among infected and non-infected subjects.

Age (Years)	Infected			Non-infected				
	Male	Female	Total	Male	Female	Total	p –value	O.R
0-5	4 (33.3)	8 (66.7)	12 (100.0)	19 (36.5)	33 (63.5)	52 (100.0)	0.83	0.9
6-11	3 (42.9)	4 (57.1)	7 (100.0)	15 (34.9)	28 (65.1)	43 (100.0)	*0.69	1.4
12-17	7 (58.3)	5 (41.7)	12 (100.0)	14 (58.3)	10 (41.7)	24 (100.0)	1.00	1.0
Total	14 (45.2)	17 (54.8)	31 (100.0)	48 (40.3)	71 (59.7)	119 (100.0)	0.78	1.2

* Fisher's Exact Test

Tab. III. Species of intestinal helminths according gender and age distribution of subjects.

Species	A. lumbricoides (%)	T. trichiura (%)
Gender		
Male (n = 14)	14 (100.0)	0 (0.0)
Female (n = 17)	14 (82.4)	3 (17.6)
Fisher's Exact: p = 0.23, OR= 7.0		
Ages (Years)		
0 – 5 (n = 12)	11 (91.7)	1 (8.3)
6 – 11 (n = 7)	5 (71.4)	2 (28.6)
12 – 17 (n = 12)	12 (100.0)	0 (0.0)
$\chi 2 = 4.17$, df = 2, p = 0.124		

One hundred and three (68.7%) of the 150 subjects wear protective foot-wears regularly at play ground and/or to school while 47 (31.3%) wear foot-wears sparingly or not at all. There was no significant difference in proportion of infected and non-infected subjects in relation to use of protective foot-wears in this study ($\chi^2 = 0.12$, p = 0.73, O.R = 0.8) (Tab. V).

Discussion

The prevalence (20.7%) of intestinal helminthiasis in children seen in orphanages in Benin City could be attributed to poor level of care in the orphanages [7, 11, 12]. The children in this present study were cared for by the orphanage staff but in most of these orphanages, the number of child to staff ratio was inappropriate. Appropriate child to caregiver ratio in orphanage is 3-4:1 as against the average of 6:1 observed in this study. Poor hygiene and level of care is usually worse in orphanages with poor child to caregiver ratio [6] and this could have been the reason for higher prevalence of intestinal helminthiasis and higher worm burden (moderate intensity) in these orphanages. Some authors have documented that improved care of children in orphanages especially where family members are allowed to participate

Tab. IV. Prevalence of intestinal helminthiasis according to the orphanages.

Orphanage	Infected (%)	Non-infected (%)	No of Caregiver per child at a time	Child to caregiver ratio
A (n = 31)	4 (12.9)	27 (87.1)	4	7.8 : 1
B (n = 13)	2 (15.4)	11 (84.6)	3	4.3 : 1
C (n = 32)	8 (25.0)	24 (75.0)	4	8.0 : 1
D (n = 6)	0 (0.0)	6 (100.0)	2	3.0 : 1
E (n = 10)	0 (0.0)	10 (100.0)	2	5.0 ; 1
F (n = 12)	6 (50.0)	6 (50.0)	1	12.0 : 1
G (n = 9)	0 (0.0)	9 (100.0)	2	4.5 : 1
H (n = 22)	9 (40.9)	13 (59.1)	3	7.3 : 1
I (n = 5)	0 (0.0)	5 (100.0)	3	1.7 : 1
J (n = 10)	2 (20.0)	8 (80.0)	2	5.0 ; 1
Total (n = 150)	31(20.7)	119 (79.3)	26	5.8 : 1

Appropriate child to caregiver ratio is 3-4:1[5]

Tab. V. Frequency of de-worming exercise in last one year and use of protective foot-wears versus intestinal helminthiasis among the subjects.

Frequency of de-worming in the last one year	Infected (%)	Non-infected (%)
None (n = 5)	1 (20.0)	4 (80.0)
Once (n = 1)	0 (0.0)	1(100.0)
Every 6 months (n = 75)	18 (24.0)	57 (76.0)
Every 4 months (n = 30)	4 (13.3)	26 (86.7)
Every 3 months (n = 39)	8(20.5)	31 (79.5)
Total (n = 150)	31 (20.7)	119 (79.3)
$\chi 2 = 1.76$, df = 4, p = 0.781		
Use of foot-wears		
Regularly (n = 103)	20(19.4)	83 (80.6)
Sparingly/Not at all (n = 47)	11 (23.4)	36 (76.6)
Total (n = 150)	31 (20.7)	119 (79.3)
$\chi 2 = 0.12$, p = 0.73, O.R = 0.80		

in the care of the children in orphanages reduces prevalence of intestinal helminthiasis [6]. Borekci et al. in 2009 observed that children in the orphanage in Mersin City, Turkey who had family members and whose family members participated occasionally in care of the children had lower prevalence of intestinal helminthiasis (3.7%) [6]. These family members improved the care of the children within the orphanages.

Poor personal care in institutions (including orphanages) worsened with increasing age of the inmates and/or duration of stay in the institutions as their caregivers could have paid more attention to the younger children [11, 12]. Though there was no significant difference in mean duration lived in the orphanages in infected subjects and non-infected ones but prevalence of intestinal helminthiasis was higher in children who had stayed longer in the orphanages and was also highest in children with ages 12-17 years. In orphanages where there were inadequate caregivers as observed in this study, it is possible that the few caregivers will pay more attention to the younger children within the orphanages and this may predispose the older children to increased risk of intestinal helminths.

The present study as in others [13, 14], generally demonstrated no significant gender difference in intestinal helminthic infection among the subjects, however intestinal helminths were more common in adolescent boys (age groups 12-17 years) when compared with girls of the same age group. Some authors have documented higher infection rate in adolescent boys than in adolescent girls; and this was attributed to better personal hygienic practices in girls than in boys within these age group [15].

The species of intestinal helminths isolated in this study included *A. lumbricoides*, and *T. trichiura*. The prominence of *A. lumbricoides* in this study may be due to the species characteristic embryonated eggs, which has enormous capacity to withstand extremes of environmental temperatures [1, 16]. Thus within the context of the season (dry and early raining season) during which the study was carried out, thriving of the ova of *A. lumbricoides* could be said to be enhanced in comparison with those of *T. trichiura*. Ekundayo et al. [2] showed that *A. lumbricoides*, *T. trichiura* and *A. duodenale* species were the common intestinal helminths isolated among pre-school and school aged children in Nigeria over a 30 year period. This was corroborated by the finding of Nwaneri et al. in Benin City in 2010 [15]. Absence of hookworm (*Ancyclostoma duodenale*) in this study could be attributed to the fact that most of the subjects wear shoes/foot-wears to school or play grounds and thus could have been protected from the hookworm larvae. The major and common portal of entry of hookworm larvae is the skin of the foot [16]. Use of footwears especially while going to farm, schools or at play grounds has been documented to be protective against the penetration of hookworm larvae in to the skin, and thus reduce the risk of hookworm infections [16, 17].

The intensity of intestinal helminthiasis was predominantly light in most of the subjects, however few subjects demonstrated moderate helminths intensity especially in those orphanages in which poor care and poor child/caregiver ratio were observed. Predominantly light intensity observed in this study could be attributed to the frequency of de-worming exercise practiced within the orphanages. Most of the children receive anthelminthic drugs every 3-6 months. Similar de-worming exercise as documented by some authors had been observed to reduce the prevalence and intensity of intestinal helminthiasis in any closed community including the orphanages [1, 15, 18]. This also can explain why there was no mixed infection of intestinal helminths in this study. Most authors however, emphasized community mobilization program in educating parents and pupils on the overall benefits of regular de-worming exercises [18]. The WHO recommended a three monthly single dose of broad spectrum anthelminthic drug in most endemic regions based on high burden of *A. lumbricoides* which takes three months to complete its life cycle [1].

Conclusion

Regular de-worming exercise (at least every 3-6 months) reduces the prevalence of intestinal helminthiasis in children living in orphanages. Child to caregiver ratio in orphanages in Benin City was inappropriate; therefore more caregivers should be employed to assist in the care of the children in orphanages.

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