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Risks of intestinal helminthiasis in children living in orphanages in Benin city, Nigeria

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Abstract Background: Risk factors of intestinal helminthiasis include poor personal hygiene/care, and behavioural aberrations such as finger sucking, nail biting and pica which had been found to enhance intestinal ova transmission.

Objectives: To determine risk factors of intestinal helminthiasis in children living in orphanages in Benin City, Nigeria.

Subjects and Methods: Fresh stool samples from 140 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-April, 2011.

Results: Prevalence of intestinal helminthiasis was 20.7%. Children ages 12 – 17 years had highest prevalence of intestinal helminths. *Ascaris lumbricoides* and *Trichuris trichiura* were the intestinal

helminths isolated. Behavioural aberrations were represented more in infected subjects than the non-infected children ($\chi^2 = 3.94$, $p = 0.047$, O.R = 2.3). Nail biting and use of common towel were the most significant independent predictors of intestinal helminthiasis ($p = 0.017$ and 0.028 respectively). Hand washing with water and soap after defecation was significantly associated with decreased prevalence of intestinal helminthiasis ($p = 0.016$). **Conclusion:** Behavioural modification, good personal hygiene and provision of towels for each child living in the orphanage should be integral part of intestinal helminths control in orphanages.

Key words: finger sucking, helminthiasis, nail biting, pica, risk

Introduction

Intestinal helminthiasis is usually a problem of pre-school and school aged children worldwide.^{1,2} In Nigeria, the prevalence of intestinal helminthic infections ranges from 14.4 – 71.1%, depending on the location and the methodology employed in the study.²⁻⁴

Risk factors of intestinal helminthiasis include poor personal hygiene/care, and behavioural aberrations such as finger sucking, nail biting and pica which had been found to encourage soil contamination by helminths ova and intestinal helminths transmission from one individual to another especially among children who live in closed communities or in institutions.³⁻⁷ Available data showed that children who possess these behavioural aberrations especially in communities with poor sanitary practices and personal hygiene are at higher risk of acquiring intestinal helminthiasis when compared to

those who do not possess them.⁵⁻⁷ Nwaneri *et al*⁵ and Giacometti *et al*⁶ in their separate studies observed that encopresis and pica were respectively major predictors of intestinal helminthiasis in children with chronic neurological disorders (cerebral palsy, epilepsy and mental retardation), while in healthy children, Herrstrom *et al*⁷ observed that finger sucking, nail biting and pica were strongly associated with *E. vermicularis*. The authors concluded that behavioural modification and improved personal hygiene (such as nail trimming, hand washing before and after meals, etc) should be integral part of control program for intestinal helminthiasis especially in institutionalized children and/or children in orphanages.⁵⁻⁷

There was an estimated 7,000,000 orphans in Nigeria in 2003 and an increase of 1,200,000 by end of 2010.^{8,9} There is paucity of published data on the prevalence of intestinal helminthiasis in children living in orphanages

in Nigeria. Ogbe *et al*¹⁰ observed a prevalence of 63.6% in an orphanage in Isolo Lagos Nigeria over two decades ago. Inadequate access to clean drinking water, health care, and poor sanitation which characterize most orphanages in developing countries (including Nigeria) were the major risk factors of this high prevalence of intestinal helminthiasis observed in the study.^{9,10} There is need to identify and document the risk factors of intestinal helminthiasis in orphanages. This study therefore set to identify risk factors to intestinal helminthiasis in children living in orphanages in Benin City, Nigeria. Findings obtained from this study could be used to institute interventional programs to reduce the prevalence of intestinal helminthiasis in orphanages.

Subjects and Methods

This cross sectional, descriptive study was carried out between January and April 2011 in 10 orphanages in Benin City, Nigeria. There were 15 registered orphanages in Benin City and all the orphanages are privately owned by individuals or corporate bodies. As at the time of this study, three of the orphanages were not functional, one 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 was excluded from the final analysis. Children with obvious chronic neurological disorders such as cerebral palsy (CP) were also excluded. These children have obvious behavioural aberrations such as pica, and encopresis which put them at higher risk of intestinal helminthiasis when compared with other children.^{5,6,11} The 10 orphanages used for this study had a total of 165 inmates. Six of the inmates were either 18 years or above; and another six children had CP. Complete data and appropriate stool samples for analysis for this study was obtained from 140 children giving a response rate of 84.8%.

Preliminary meetings were held with the proprietors/ proprietresses of the selected orphanages where the outline of the programme was explained in details. An informed written consent was signed by each proprietors/ proprietresses and an assent obtained from older children within the orphanage for participating in the study. 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.

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,¹² and

the 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 calculate the number of eggs per gram of faeces (WHO 1998)¹² 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.¹²⁻¹⁴ All the slides were read by one medical microbiologist specialized in parasitology and a second reading of the slides were done by the same microbiologist to ensure consistency. Another reading was done after 24 hours for search for ova of *Schistosoma mansoni* by the same microbiologist.^{12,13} Intensity of infections for each worm was defined according to the thresholds proposed by the World Health Organization (WHO) Expert Committee in 1987.¹³

Data Analysis

The data obtained was entered into spread sheet using the Microsoft Excel 2007 and the analysis was done using the Statistical Package for Scientific Solutions (SPSS) versions 11.0 and 16.0 softwares (SPSS Inc Chicago, Illinois, USA). The proportion of children who had ova of helminths in stool was used to calculate the prevalence of intestinal helminthiasis in this study. 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 for comparison of proportions while student t -test was used for comparison of mean. Binary logistic regression was used to obtain predictors of intestinal helminthiasis in children seen at the orphanages using the obtained risk factors as independent variables against whether or not the child has positive ova of helminths in stool (infected and non-infected) as dependent variable. The level of significance of each test was set at $p < 0.05$.

Results

The subjects consisted of 60 (42.9%) boys and 80 (57.1%) girls; mean age (\pm SD) was 7.1 ± 4.7 years, and mean (\pm SD) years lived in the orphanage was 3.5 ± 3.4 years.

Prevalence of intestinal helminthiasis in children seen in orphanages was 29/140 (20.7%). Age of infected subjects (9.1 ± 4.5 years) was significantly higher than 6.6 ± 4.6 years observed in non-infected subjects ($t = 2.69$, $p = 0.01$, 95% C.I = 0.63, 4.40). Prevalence of intestinal helminthiasis was virtually the same among the age groups 0 – 5 year and 6 – 11 years, thereafter, there was marked increase in prevalence at ages 12 – 17 years

(Figure 1). There was no significant gender difference in helminthic infection: 15/29 (51.7%) girls and 14/29 (48.3%) boys ($\chi^2 = 0.44$, $p = 0.53$, OR = 1.3).

Species of intestinal helminths isolated were *A. lumbricoides* in 26/29(89.7%) and *T. trichiura* in 3/29 (10.3%) of subjects.

Among the 140 subjects, 46 (32.9%) had one or more behavioural aberration such as nail biting, finger sucking and pica. Nail biting was the most frequent behavioural aberration observed in 37/140 (26.4%) of the subjects, finger sucking 8/140 (5.7%) and then pica, one (0.7).

Fourteen (48.3%) of the 29 infected subjects possess significantly one or more of the behavioural aberration

(finger sucking, nail biting and pica) when compared with 32/111(28.8%) observed among the non-infected subjects ($\chi^2 = 3.94$, $p = 0.047$, O.R = 2.3).

Table 1 shows the distribution of the behavioural aberration among the infected and non-infected subjects. Subjects with nail biting significantly were infected with intestinal helminthiasis ($p = 0.04$) and were about 2 times more likely to acquire the disease (Table 2). Proportion of children with nail biting increases with increase in age as against finger sucking and pica which were more common among the pre-school and school ages (less than 12 years old).

Table 1: Behavioural aberration among infected and non-infected subjects

Behavioural Aberration	Infected n=29 (%)	Non-infected n = 111 (%)	p-value	O.R	95% C.I
Nail biting present	12 (41.4)	25 (22.5)	0.04	2.40	1.02, 5.76
No nail biting	17 (58.6)	86 (77.5)			
Finger sucking present	2 (6.9)	6 (5.4)	0.76*	1.30	0.24, 6.79
No finger sucking	27 (93.1)	105 (94.6)			
Pica present	1 (3.4)	0 (0.0)	0.21*	7.90	0.47, 296.03
No pica	28 (96.6)	111 (100.0)			

O.R = Odds Ratio; C.I = Confidence Interval; *Fisher's Exact test

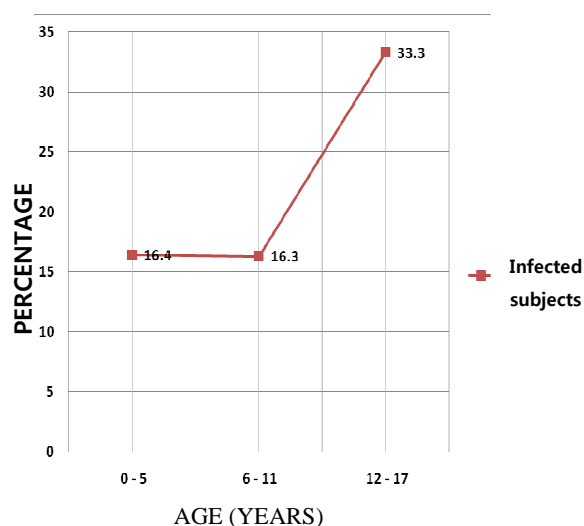


Fig 1: Age distribution of infected subjects

Eighty-eight (62.9%) of the children use common towel to clean their body after bathing. These towels were washed usually once every week. One quarter of these 88 that use common towel had intestinal helminths.

Another behavioural risk factors of intestinal helminthiasis observed was wearing of dirty long nails in 99/140 (70.7%). Binary logistic regression model using presence of ova of intestinal helminths (infected and non-infected) as dependent variable and behavioural risk factors (nail biting, finger sucking, and pica) and personal hygiene (use of common towel, wearing of long and/or dirty finger nails, frequency of body bath per day, hand wash practices before and after meals and regular use of footwears) as independent variable showed that nail biting and use of common towel independently were the significant predictors of intestinal helminthiasis in this study (Table 2).

Each orphanage 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 always had at least a tablet of toilet soap for hand washing.

Eighty-four (60.0%) of the 140 subjects clean them-

selves after defecation while 56 (40.0%) were being cleaned by care-givers. Seventeen (12.1%) of the 140 subjects do not wash their hands after defecation; while in 123 (87.9%) subjects, hand washing practices were observed by both subjects and/or their care-givers.

Prevalence of intestinal helminthiasis (47.1%) was significantly higher among subjects (or their caregivers) who do not wash their hands after defecation when compared with 17.1% observed among those who wash their hands with water and soap ($\chi^2 = 8.28$, $df = 2$, $p = 0.016$).

Table 2: Binary logistic regression models of predictors of intestinal helminthic infections in subjects							
Behavioural risk factors		Infected	Non-infected	β	t	O.R	p-value
<i>Behavioural aberration</i>							
Nail biting	(n = 37)	12 (32.4)	25 (67.6)	1.20	5.71	2.40	0.017
Finger sucking	(n = 8)	2 (25.0)	6 (75.0)	-0.20	0.03	1.30	0.865
Pica	(n = 1)	1 (100.0)	0 (0.0)	24.19	0.00	11.74	1.000
<i>Hand wash and meals</i>							
Before meals- Yes	(n = 98)	23 (23.5)	75 (76.5)	1.06	2.51	1.84	0.113
No	(n = 42)	6 (14.3)	36 (85.7)				
After meals- Yes	(n = 123)	27 (22.0)	96 (78.0)	-0.27	0.08	2.11	0.780
No	(n = 17)	2 (11.8)	15 (88.2)				
<i>Use of common towel</i>							
Yes	(n = 88)	22 (25.0)	66 (75.0)	1.19	4.85	2.14	0.028
No	(n = 52)	7 (13.5)	45 (86.5)				
<i>Dirty finger nails</i>							
Yes	(n = 99)	19 (19.2)	80 (80.8)	-0.40	0.56	0.74	0.454
No	(n = 41)	10 (24.4)	31 (75.6)				
<i>Finger nails trimmed</i>							
Yes	(n = 76)	16 (21.1)	60 (78.9)	-0.23	0.19	1.04	0.651
No	(n = 64)	13 (20.3)	51 (79.7)				
<i>Number of bathing times per day</i>							
Twice daily- Yes	(n = 127)	25 (19.7)	102 (80.3)	-0.73	1.04	0.55	0.307
No	(n = 13)	4 (30.8)	9 (69.2)				
Once daily- Yes	(n = 13)	4 (30.8)	9 (69.2)	-0.73	1.04	0.55	0.307
No	(n = 127)	25 (19.7)	102 (80.3)				
<i>Regular Use of foot wears</i>							
Yes	(n = 97)	18 (22.8)	79 (77.2)	-0.37	0.51	0.66	0.475
No	(n = 43)	11 (25.6)	32 (74.4)				

β = measure of how strongly each predictor variable influences the dependent variables, O.R = odds ratio, p-value

Discussion

Behavioural aberration such as nail biting, finger sucking, encopresis, and pica observed in some children have been postulated as important risk factors that may encourage soil contamination by helminths ova and intestinal helminths transmission from one individual to another especially children living in closed communities or in institutions.⁵⁻⁷ This study showed that behavioural aberrations (nail biting, finger sucking and pica) were significantly observed among the infected subjects than

non-infected ones. These children were about two times more likely to acquire intestinal helminthiasis compared to children who do not possess these behavioural aberrations. This finding corroborated with those of some authors who observed that behavioural aberrations are significant risk factors of intestinal helminthiasis in children who possess them.⁵⁻⁷ The consensus by these authors was that children who are in communities with poor sanitary practices and who possess these behavioural aberrations as observed in this study are at higher risk of acquiring intestinal helminthiasis when compared to those who do not possess them.⁵⁻⁷ Majority of the children had long and dirty finger nails. The helminths

ova can lodge under the finger nails and can then be transmitted faeco-orally during finger sucking or nail biting.

Towels used by individuals are good illustration of fomites and could be a source of disease transmission from one person to another.¹⁵ Majority of the children in the orphanages use common towel to clean their body after bathing. These towels can serve as fomites since ova of helminths can lodge into these towels and then serve as sources for environmental contamination and transfer of ova from one person to another. It has been documented that disinfection of fomites in hospitals and closed communities is an effective infection transmission control.¹⁶ Therefore, each child in the orphanages should be provided with at least one towel and there should be regular washing of these towels which could serve as means of reducing intestinal helminths transmission in the orphanages.

Highest prevalence of intestinal helminths was observed in the adolescent age group. The caregivers may have paid more attention to the younger children within the orphanages than to the older children. Some authors have observed that poor personal hygiene is a major risk factor of intestinal helminthiasis in this age group.¹⁷ Nail biting which was observed in about one third of these age group and poor personal hygiene in these children could have proffered the reason for high prevalence of intestinal helminthiasis among this age group.

Regular hand washing with soap is a universal precaution that prevents disease transmission.^{18,19} Hand washing after defaecation has been identified as an effective preventive measure for intestinal helminthiasis.^{3,5} Lower prevalence of intestinal helminthiasis has been observed in children who washed their hands with water and soap (or those whose care-givers do so) after using the toilet.^{3,5} The findings observed in children who washed their hands with soap and water in this study is in consonance with those observed by Wagbatsoma *et al*³ in 2008 among primary school children in Egor District, Edo Nigeria. The above assertions perhaps attest to the efficacy of soap as an important agent in hand washing practices against intestinal helminths ova.¹⁹

Ascaris lumbricoides and *Trichuris trichiura* were the intestinal helminths isolated in this study. Absence of hookworm could be attributed to regular use of footwears to school or in the play ground within the orphanages. Studies have shown that children who do not wear footwears regularly to school, playground or farm are at increased risk of hookworm infection.^{2,3,4,20} The larvae of hookworm penetrate through unbroken skin (usually of the leg).³ Majority of the children in this study regularly use footwears either to school or playground and were therefore protected against hookworm infections.

Future research questions: It could be postulated that children in orphanages had sub-optimal care and may be predisposed to diseases including intestinal helminthiasis.²¹ There is the need to assess the level of care of

children living in orphanages in Benin City as well as compare the prevalence and risks of intestinal helminthiasis in children living in orphanages and that of age /sex matched children living with their parents.

Limitation of study: Exclusion of *Enterobius vermicularis* in this study due to inability to procure cellulose tape necessary to capture the ova of the helminths for analysis.

Conclusion

Use of common towel and nail biting among the children living within the orphanages are significant risk factors of intestinal helminthiasis. Provision of towels for each child and regular cutting of finger nails of children living in orphanages should be part of intestinal helminths control in orphanages.

Authors Contributions

Nwaneri DU: Conception and design ,collection of data, manuscript drafting
 Omuemu VO: Data analysis and Revising the manuscript for intellectual content

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