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SOME BEHAVIOURAL RISK FACTORS FOR INTESTINAL HELMINTHIASIS IN NURSERY AND PRIMARY SCHOOL CHILDREN IN ENUGU, SOUTH EASTERN NIGERIA

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ABSTRACT
The objective of this study was to determine some common behavioural risk factors for intestinal helminthiasis in nursery and primary school children in Enugu.

Design: A cross-sectional survey on 460 children attending nursery and primary schools in Enugu was carried out in 2003 with a view to determine some behavioural risk factors for intestinal helminthiasis.

Setting: This study was carried out in the research laboratory of the Federal Ministry of Health, National Arbovirus and Vector Research Centre, Enugu.

Method: Intestinal helminthiasis was diagnosed using the kato-katz method in analysing fresh stool samples collected from nursery and primary school children in Enugu. These fresh stool samples were collected into appropriately labeled clean containers. Questionnaires were administered by the researchers to obtain data from the children and their parents or guardians as regards some behavioural risk factors for intestinal helminthiasis .

Results: The results from this study showed that the prevalence of intestinal helminthiasis was significantly affected by various behavioural risk factors.
The rate of helminthic infection varied significantly with hand washing habits after defeacation ($X^2 = 75.77$; df = 2; p = 0.001) and with different habits of washing fruits before eating ($X^2 = 52.79$; df = 2; p = 0.001) among the pupils. Also, the rate of helminthic infection varied significantly with the source of drinking water ($X^2 = 55.12$; df = 3; p = 0.01), water boiling habits ($X^2 = 40.89$; df = 2; p = 0.001), use of footwear after school hours ($X^2 = 30.72$; df = 2; p = 0.001). Sites utilized for defeacation by the pupils ($X^2 = 80.25$; df = 3; p = 0.001) also significantly influenced the rate of helminthic infection.

Conclusion: Various behavioural factors which significantly affect the rate of helminthic infection abound in children living in Enugu. The government should give attention to the control of these behavioural risk factors. A lot of health education will be needed to curb the poor personal hygienic habits which are obvious risk factors for intestinal helminthiasis.

Key Words: Intestinal helminthiasis, children, behavioural risk factors. *(Accepted 10 July 2009)*

INTRODUCTION
Infection with intestinal roundworm is the most common type of helminthiasis.[1] These infections are more prevalent in the tropics like Nigeria. Generally speaking, children are more heavily infected than adults and are therefore more likely to suffer from the pathologic consequences of these infections. Intestinal helminths have been associated with a considerable amount of morbidity in children in the developing countries.[2] Intestinal helminths infect children either directly by the ingestion of mature eggs through the mouth via contaminated food, or indirectly via larval penetration of the skin.

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Intestinal helminthic infection causes some health problems which in turn are aggravated by poor sanitary environments which encourage the transmission of these infections.[3-7] Helminths play an important role as contributory factors in the aetiology of childhood malnutrition because heavy chronic infection may aggravate or precipitate malnutrition.[7,8] Intestinal helminthiasis in Nigerian children is well documented.[9-17]
Despite the fact that many authors have researched into the pattern of intestinal helminthiasis in Nigerian children, only few have investigated into the common behavioural risk factors that predispose to these infections. Specifically in Enugu, the previous researches known to the authors of this work have not demonstrated most of these behavioural risk factors.

The present study was therefore carried out to evaluate some of the common behavioural risk factors for intestinal helminthiasis among nursery and primary school children in Enugu.

PATIENTS AND METHODS

The research was carried out in Enugu metropolis. Enugu is the capital of Enugu State located in the south-eastern part of Nigeria. The population of Enugu State as at the year 2000 was 2,751,192 out of which 1,294,517 were males and 1,456,675 were females.[18] There are 73 approved nursery schools and 139 approved primary schools in Enugu. The study population consisted of children attending nursery and primary schools in Enugu who were less than 10 years.

The subjects were drawn from 3 randomly selected nursery and 3 randomly selected primary schools in Enugu. A total of 460 students comprising 139 nursery and 321 primary school pupils completed the study. The study period was between the months of August and September 2003. These pupils were selected via the multi-stage sampling method after getting full consent from their parents or guardians as well as assent from older children as the case may be. The sample size was obtained using a standard formula[19] and using the prevalence documented in a previous study in Enugu.[9]

This study was reviewed and approved by the ethical committee of the University of Nigeria Teaching Teaching Hospital, Enugu. The researchers used the direct interview method to administer an already pre-tested and re-structured questionnaire. The questionnaires included questions that highlighted the common behavioural risk factors for intestinal helminthiasis.

Stool samples were collected with clean, fully labeled specimen containers which were given to each enrolled child at school dismissal and to be collected on the next morning before coming to school. The collected stool samples were immediately submitted to the researchers on arrival at school and subsequently taken to the laboratory where they were immediately refridgerated. The analysis was carried out same day at the Federal Ministry of Health, National Arbovirus and Vector Research Division, Enugu using the kato-katz method.[20] Each slide was examined within 30 minutes to detect the ova of hookworm and later reviewed to detect other intestinal helminths. Children who had intestinal helminths in their stools were treated freely by the researchers with appropriate dosage of oral mebendazole. The parents or guardians as well as the children alike were educated on the ways of prevention of helminthiasis.

Statistical analysis

The data was analysed with statistical package EPI-INFO version 6.4. The statistical significant differences were checked for various risk factors using the chi-square and Yates correction factor where necessary. A probability of < 0.05 was considered significant.[21]

RESULTS

Helminthiasis versus defaecation sites

The prevalence of helminthic infection varied with different defeacation sites. Out of all the children that were infected, 50 (33.3%), 67 (44.7%), 14 (9.3%) and 19 (12.7%) children defaecated in pit latrines, bush, potty and water cistern respectively. This is shown in Table1. There was a significant relationship between the presence of helminth and the site of defaecation ($X^2 = 80.25$; df = 3; p = 0.001). The use of bush and pit latrines predisposed the children to helminthic infection more than the use of other facilities. There was also a significant difference in the rate of infection when children who used bush were compared to those who used pit on the one hand ($X^2 = 10.89$; df = 1; p = 0.001) and to those who used potty on the other hand ($X^2 = 41.22$; df = 1; p = 0.001) and even when compared to those who used water cistern ($X^2 = 64.36$; df = 1; p = 0.001). The rate of helminthic infection was also significantly higher in the children who used pit when compared to those who used potty ($X^2 = 13.86$; df = 1; p = 0.001) and to those who used the water cistern ($X^2 = 25.01$; df = 1; p = 0.001). There was however, no significant difference in the rate of infection in children who used potty when compared to children who used the water cistern ($X^2 = 0.36$; df = 1; p = 0.55).

Table 1: Defaecation Sites of Subjects and Prevalence of Helminthiasis.

Defaecation site	Presence of helminth		Total
	Yes (%)	No (%)	
Pit latrine	50 (33.3)	74 (23.9)	124 (27.0)
Bush	67 (44.7)	41 (13.2)	108 (23.5)
Potty	14 (9.3)	72 (23.2)	86 (18.7)
Water cistern	19 (12.7)	123 (39.7)	142 (30.9)
Total	**150**	**310**	**460**

$X^2 = 80.25$; df = 3; p = 0.001

The type of helminths in infected children in relation to the defaecation sites is as shown in Table 2. There was predominance of hookworm infection in children who defaecated in the bush when compared to children who used other sites. There was however, no significant relationship between the sites of defaecation and the type of helminthic infection ($X^2 = 9.76$; df = 6; p = 0.14).

Table 2: **Defaecation Sites and Prevalence of Different Types of Helminthic Infection.**

Defaecation sites	No. infected (%)	Type of helminth (%)		
		A. lumbricoides	Hookworm	*T. trichiura*
Pit	50 (33.3)	25 (50.0)	17 (34.0)	8 (16.0)
Bush	67 (44.7)	25 (37.3)	34 (50.7)	8 (12.0)
Potty	14 (9.3)	6 (43.0)	4 (29.0)	4 (29.0)
Water cistern	19 (12.7)	11 (58.0)	4 (21.0)	4 (21.0)
Total	**150**	**67**	**59**	**24**

$X^2 = 9.76$; df = 6; p = 0.14

Helminthiasis and source of drinking water

Out of the 150 infected children, 96 (64.0%), 27 (18.0%), 19 (11.3%) and 10 (6.7%) drank predominantly water from streams, wells, tanker-borne and pipe-borne water respectively (Table3). The prevalence of infection was highest in children who used stream water as a source of drinking water. There was a significant difference in the rate of infection in children who used water from streams and wells when compared with the rate in children who used pipe-borne and tanker-borne water ($X^2 = 53.34$; df = 1; p = 0.001). There was no statistically significant difference in the rate of infection between children who used streams and those who use wells as their source of drinking water ($X^2 = 0.58$; df = 1; p = 0.46). In addition, there was no significant difference in the rate of infection in children who drank tanker-borne water when compare to the rate of infection among children who drank tap water (X^2 =2.11; df = 1; p = 0.15).

The prevalence of helminthic infection was dependent on the practice or not of boiling of drinking water irrespective of source ($X^2 = 62.38$; df = 6; p = 0.001) (Table3). Children who had no access to boiled water had a higher risk of infection when compared to those who used water that was boiled routinely ($X^2 = 39.35$; df = 1; p = 0.001). On the other hand, there was no statistically significant difference between children who had access to water not boiled at all and those who drank water that was boiled occasionally ($X^2 = 0.11$; df = 1; p = 0.75).

Table 3: **The Act of Boiling Drinking Water, and Its Relationship to Prevalence of Helminthiasis.**

Drinking water source	Boiled water before drinking (% infected)			Total (%)
	Did not	Occasionally	Routinely	
Stream	78 (81.3)	15 (15.6)	3 (3.1)	96 (64.0)
Well	13 (48.2)	12 (44.4)	2 (7.4)	27 (18.0)
Tanker borne	10 (58.8)	1 (5.9)	6 (35.3)	17 (11.3)
Pipe borne	1 (10.0)	2 (20.0)	7 (70.0)	10 (6.7)
Total	**102 (68.0)**	**30 (20.0)**	**18 (12.0)**	**150**

$X^2 = 62.38$; df = 6; p = 0.001

Hand washing after defaecation and prevalence of helminthiasis

Out of the 150 infected children, 18 (12.0%) consistently and 56 (37.3%) occasionally washed hands after defaecation while 76 (50.7%) would not wash their hands after defaecation as shown in Table 4.

A significant relationship was observed between the rates of infection and hand washing after defaecation ($X^2 = 75.77$; df = 2; p = 0.001). Specifically, there was a significant difference in the rates of infection when children who did not wash hands after defaecation were compared with those who washed their hands occasionally ($X^2 = 56.82$; df = 1; p = 0.001) and those who washed consistently ($X^2 = 52.66$; df = 1; p = 0.001). However there was no significant difference in the rates of infection in children who occasionally washed hands after defecation and children who consistently did (X^2 = 2.04, df = 1, p =0.154). In addition different hand washing habits did not significantly affect the acquisition of specific helminthic infection ($X^2 = 1.86$; df = 4; p=0.76).

Table 4: **Hand Washing After Defaecation and Prevalence of Helminthic Infection.**

Hand washing after defaecation	No. infected (%)	Type of helminth (%)		
		A. lumbricoides	Hookworm	*T. trichiura*
Nil	76 (50.7)	31 (46.3)	33 (55.9)	12 (50.0)
Occasionally	56 (37.3)	26 (38.8)	21 (35.6)	9 (37.5)
Consistently	18 (12.0)	10 (14.9)	5 (8.5)	3 (12.5)
Total	**150**	**67**	**59**	**24**

$\times^2 = 1.86$; df = 4; p = 0.76

Washing of fruits versus prevalence of helminthiasis

Respectively, 23 (15.3%) and 78 (52.0%) regularly and irregularly washed fruits before eating while 49 (32.7%) did not do so at all (see table 5). The prevalence of infection was significantly higher in children who did not wash fruits before eating when compared to those who did regularly (X^2 =48.86, df = 1, p = 0.001) and to those who did irregularly (X^2 = 33.02, df = 1, p = 0.001). Also the infection rate was significantly higher in children who washed fruits irregularly when compared to those who did regularly (X^2 = 6.55, df=1, p=0.010). *A. lumbricoides* was predominant in children who did not wash fruits before eating, followed by hookworm and then *T. Trichiura.*

Table 5: **Washing of Fruits Before Eating and Prevalence of Helminthiasis.**

Washing of fruits before eating	No. Infected (%)	Type of helminth (%)		
		A. lumbricoides	Hookworm	*T. trichiura*
Did not	49 (32.7)	24 (35.8)	18 (30.5)	7 (29.2)
Irregular	78 (52.0)	33 (49.3)	32 (54.2)	13 (54.2)
Regular	23 (15.3)	10 (14.9)	9 (15.3)	4 (16.6)
Total	**150**	**67**	**59**	**24**

There was however no significant relationship between the act of washing fruits before eating and the type of helminthic infection acquired (X^2 = 0.331, df = 4, p=0.99).

Not wearing of foot wears after school hours in relation to the prevalence of helminthiasis.

Seventy -six (50.1%) of the 150 infected children did not put on foot wears after school hours while 65 (43.3%) and 9(6%) occasionally and always did respectively (as shown in table 6). The prevalence of infection was significantly higher in children who did not use foot wear when compared to those who always did (X^2 =22.60, df=1, p=0.001) and to those who did occasionally (X^2 = 35.41, df = 1, p =0.001). In addition, among the infected children, the proportion with hookworm was higher among children who did not use foot wears after school hours (74.6%) compared to consistent foot wear users. Not wearing of foot wears after school was significantly associated with risk of acquisition of intestinal helminths (X^2 = 30.72, df = 2, p=0.001).

Table 6: **Relationship between not wearing of Foot Wears after School Hours and Prevalence of Helminthiasis.**

Wearing of foot wear after school hours	Total (%)	Type of helminth (%)		
		A. lumbricoides	Hookworm	*T. trichiura*
Always	9 (6)	5 (7.5)	1 (1.7)	3 (12.5)
Occasional	65 (43.3)	40 (59.7)	14 (23.7)	11 (45.5)
Did not	76 (50.1)	22 (32.8)	44 (74.6)	10 (41.7)
Total	**150**	**67**	**59**	**24**

(X^2 = 30.72, df = 2, p = 0.001)

DISCUSSION

The study clearly demonstrates the effects of poor hygienic behaviour on the prevalence of intestinal helminths. The rate of helminthic infection which varied with the different sites of defeacation with the highest prevalence in those that used bush as a defeacation site agrees with the findings of some other authors[6]. This is likely since bushes which serve as defeacation sites become contaminated with larvae of helminths released in the faeces and children may visit such sites on bare feet thus predisposing them to helminthic infection. Also, children who defeacate in the bush are likely to be the ones who would not wash their hands thereafter since they are unlikely to have access to water in such circumstances. Majority of the children who had hookworm infection used bush as a defeacation site. The act of using bush as a defeacation site may suggest that such children who are involved in this act do not have adequate toilet facility at home perhaps due to poverty. Again, due to poverty, these same children are more likely to walk on bare feet even when going to the bush to defeacate; hence, they are likely to contact hookworm infection.

On the other hand, this significant association between helminthic infection and the usage of bush as a defeacation site contradicts the finding by Feachem et al who found that the type of toilet facility utilized by some of his subjects did not have a significant association with helminthic infection.[22]

A higher prevalence of intestinal helminthic infection was found in children who did not wash their hands after defeacation compared with other children who washed their hands after defeacation.

This agrees with the observation of some other authors[23,24] that helminthic infection is due mainly to contact with feacal matter and is therefore related to the standard of personal and environmental hygiene in the community.

The finding in this study that children who did not wash fruits before eating had significantly higher rate of helminthic infection when compared to those who regularly did wash fruits before eating them, and to those who washed their fruits but irregularly is not surprising. This may be due to the fact that most fruits were picked commonly en route to and from school and included common fruits like mangoes, guavas and cashews. The increased presence of *Ascaris lumbricoides* and *Trichuris trichiura* in these children who did not wash fruits before eating is expected since these worms are transmitted faeco-orally.

Children in this study who did not put on footwear regularly after school hours had higher rate of worm infestation. This may be due to the poor health knowledge of the fact that footwear protect against acquisition of some helminthic infections. The finding in this study that majority of the children who did not use footwear regularly had hookworm infection is likely due to the fact that hookworm is mainly transmitted by cutaneous penetration which occurs when these children walk around on bare feet.

This study also highlighted the fact that infection was higher in children who drank water from streams and wells compared with those whose source of drinking water was tanker-borne water and tap. This is likely because in our environment, solid wastes including faeces are sometimes disposed of indiscrimately and rain may then carry these wastes down to the streams and uncovered wells, hence contaminating them and increasing the risk of faeco-oral transmission. Also, the containers used to draw water out of wells may themselves be carriers of infective helminthic agents and could introduce such helminths into the well. This contamination of well water with infective agents has been documented by various authors.[25-27] This significant association between helminthic infection and use of stream and well water as sources of drinking water is also in keeping with the report by Vanderslice and co-workers[23] who noted that adequate provision of clean drinking water reduces faeco-oral transmission. The sparing effect of pipe-borne water is likely due to absence of contamination with faeco-orally transmitted helminthic agents perhaps because of water plant pre-treatment of water or because of minimal contact with faecal wastes.

In this study, majority of the children drank unboiled water routinely. This may reflect some level of ignorance on the part of parents especially the mothers on the common methods of water purification. This is because, though majority of them were left with stream and well water as their cheapest sources of drinking water, the quality can to some extent be enhanced by boiling the water before drinking. Poverty may also be contributory to the act of drinking unboiled water. This is because some mothers may know that boiling can purify water but may lack the finance to purchase the fuel with which to boil the water.

In conclusion, the prevalence of intestinal helminthiasis in Nigeria is higher in children who have poor behavioural hygienic habits as highlighted in this study. Control of intestinal helminthiasis in Nigeria will therefore not be possible unless adequate preventive measures are instituted by the government against these risk factors. There is need for government to provide the grossly lacking adequate safe, pipe-borne water for all. Parents and children should be encouraged to boil and filter water from other sources before drinking since boiling will eliminate the helminthic ova and infective larva that may be existing in these other water sources. The government should also provide adequate ventilated improved latrines in schools and in the communities and discourage using bush as a site of faecal disposal. Finally, intensive health education and global deworming programmes should be carried out from time to time, in schools, religious gatherings, and the community at large.

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