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A Comparative Study on the Prevalence of Intestinal Helminthes in Dewormed and Non-Dewormed Students in a Rural Area of North-Central Nigeria

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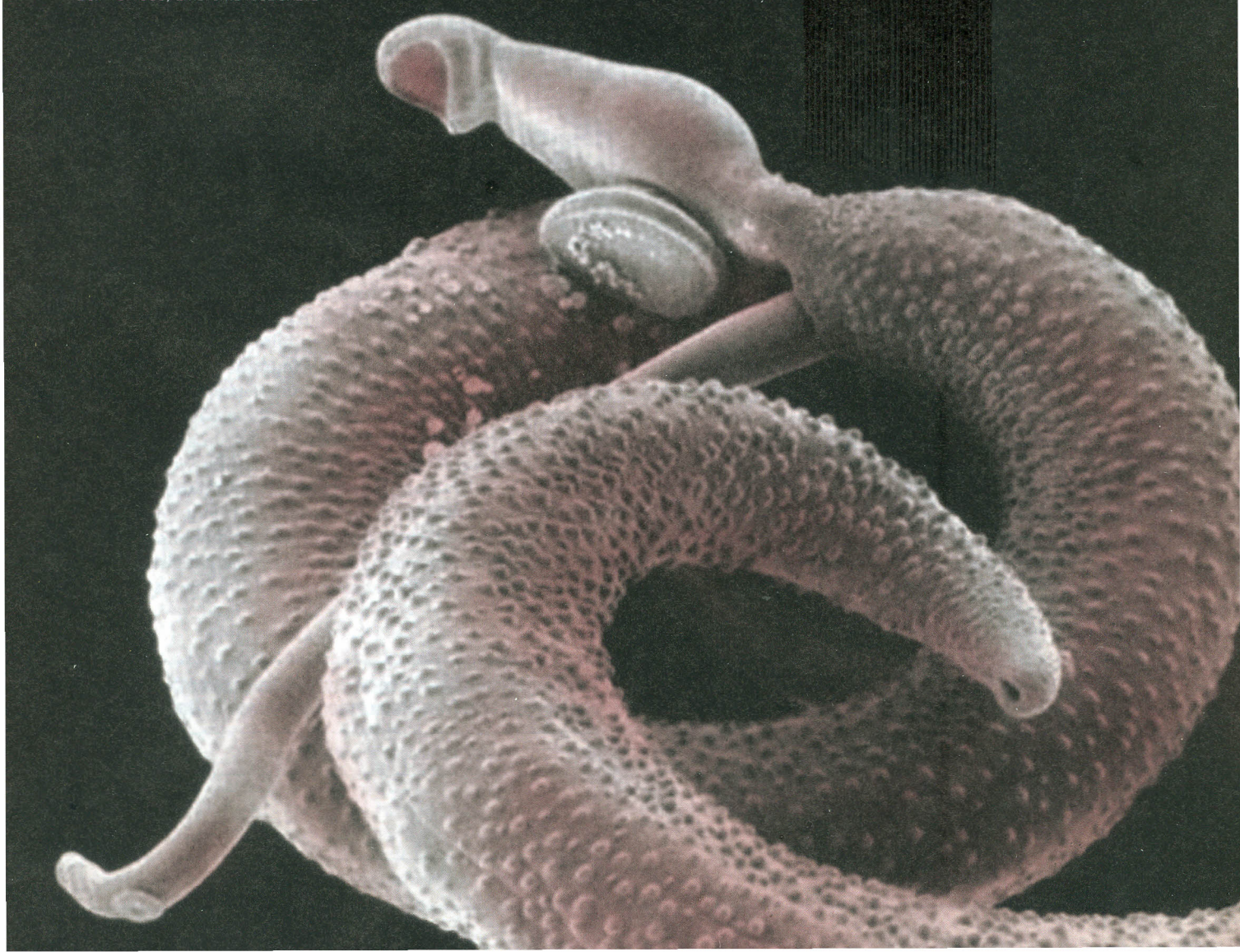

Parasitic helminthes are endemic in Nigeria, owing to poor environmental sanitation, pollution, and contamination of water and air. Children in Nigeria are highly exposed and very vulnerable to these infections, and these infections have adverse effects on their physical and mental development. School children, then, are good targets for mass-treatment programs against intestinal worms; treating children has been shown to reduce transmission to untreated members in communities. This study determines the effectiveness of deworming school children with a view to improving the planning and implementation of control programs in the study area and reveals that regular use of broad-spectrum anti-helminth medication is advocated for effective deworming programs.

Keywords: microbiology, intestinal helminthes, *Taenia spp.*, *Ascaris*, *Trichuris*, hookworm

Parasitic helminthes are known to be endemic in developing countries, including Nigeria, owing to poor environmental sanitation in communities, improper disposal of waste (including human feces and other organic waste), gross environmental pollution with agrochemical and industrial waste, and the steady contamination of water and air.[1] It was estimated that more than 1 billion people are chronically infected with soil-transmitted worms, including *Ascaris*, *Trichuris*, and hookworm infections.[2] The high prevalence of these infections is closely linked with poverty, poor environmental hygiene, and health service providers having an inadequate supply of drugs. Children and pregnant women are mostly vulnerable to these infections.[3] Intestinal helminth infections have adverse effects on the physical and mental development in poorly nourished community populations.[4] School children, in particular, are good targets for mass-treatment programs against intestinal worms because they have the heaviest infections. Treating children has been shown to reduce transmission to untreated members of the community.[5]

Children born in a Nigerian village are highly exposed to parasitic infection almost throughout their lifetimes. In rural and urban environments, water used for drinking and domestic purposes, food and vegetables, the soil, and insect bites are all sources of parasitic infection.[6]

Studies targeting these age groups for effectively treated intestinal helminthes can demonstrate a reduction in the morbidity and mortality arising from parasitic helminth infections. This study determines the effectiveness of deworming school children with a view to improving the planning and implementation of control programs in the area.

Materials and Methods

Doi represents a typical village in a rural area of Nigeria with the usual characteristics of the absence of social amenities (such as pipe-born water, electricity, a good road network, and healthcare facilities). The population of Doi consists mainly of farmers, traders, and artisans with a few public servants. This village is situated in Plateau State, north-central Nigeria. Prior to commencement of the study, permission was sought from the school authorities and the parents of the students. The study was carried out between January 2007 and March 2007. Two groups of students were compared. Group A comprised 250 students selected at random across all school class levels. They were given a single dose of combantrin and, after 1 month, they were given clean, dry, wide-mouth, transparent containers to collect their stool specimens. Group B comprised 250 pupils who did not take any anti-helminth drugs, either at home or at school, within the period of the study. Information was obtained through a questionnaire designed and completed by their parents. Each stool sample was examined macroscopically and prepared for microscopic examination using the formol-ether concentration method described by Allen and Ridley.[7] Preparations were subsequently examined for intestinal helminth eggs and larvae using 10× and 40× objectives in the parasitology laboratory of Federal School of Medical Laboratory Science, Jos.

Statistical Analysis

The results were analyzed using Epi Info statistical software v. 2002 (CDC, Atlanta, GA) where applicable. The chi square test (χ^2) was used to compare the association among proportions of the 2 groups. A P value <0.05 was considered significant.

Results

Stool samples from the 250 students in group A were examined, and 32 were positive for intestinal helminthes, giving a prevalence of 12.8%. In group B, 119 were positive for intestinal helminthes, giving a prevalence of 47.6% (**Table 1**). These differences were statistically significant (P<0.05). From a total of 500 student samples examined, 151 were positive for intestinal helminthes, giving an overall prevalence of 30.2%.

Table 2 shows the prevalence of intestinal helminthes in relation to student age. In group A, prevalence was highest in 6- to 10-year-olds and lowest in the 11- to 15-year-old population (15.2% and 10.0%, respectively). In group B, prevalence was also highest in 6- to 10-year-olds but was lowest in the 16- to 20-year-old population (66.7% and 27.8%, respectively).

Table 3 shows the prevalence of intestinal helminthes in relation to gender. In both groups, males had a higher prevalence (13.6% and 52.9% in groups A and B, respectively)

Table 1_Prevalence of Intestinal Helminthes in Dewormed and Non-Dewormed Students in Doi Village

Group	No. Examined	No. Positive	Prevalence (%)
A*	250	32	12.8
B**	250	119	47.6
Total	500	151	30.2

**dewormed students; **non-dewormed students. χ^2=71.814; df=1; P=0.000; P<0.05.*

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compared with females (11.9% and 42.6% prevalence in groups A and B, respectively). The total prevalence of intestinal helminthes for males and females was 12.8% in group A and 47.6% in group B.

In order of prevalence, the types of intestinal helminthes encountered in group A comprised hookworm (41.7%), *Schistosoma mansoni* (25.0%), *Ascaris lumbricoides* and *Strongyloides stercoralis* (both with a 13.9% prevalence), *Trichuris trichiura* (5.6%), and *Taenia spp.* (2.8%). In group B, intestinal helminthes encountered comprised hookworm (33.5%), *Ascaris lumbricoides* (28.5%), *Strongyloides stercoralis* (18.4%), *Trichuris trichiura* (13.3%), *Schistosoma mansoni* (5.1%), and *Taenia spp.* (0.6%) (**Table 4**).

Table 5 shows the frequency of polyparasitism by age group. In study group A, the highest frequency was seen in students from 1 to 5 years of age, and the lowest was seen in the 16- to 20-year-old population (5.56% and 0%, respectively). In study group B, the highest frequency was seen in students from 6 to 10 years of age, and the lowest was also seen in the 16- to 20-year-old population (18.0% and 11.1%, respectively).

Discussion

The results of this study showed an overall 30.2% prevalence of intestinal helminthes in all subjects from both study groups. This finding is comparable with previous studies by Meremikwu and colleagues[4] (in their study of intestinal helminthiasis in preschool children of peasant farmers in Calabar, southeast Nigeria), Salako and colleagues[8] (in their study of helminthiasis among primary school children in Lagos, southwest Nigeria), and Luka and colleagues[9] (in their study of helminthiasis among primary school children in the Lere Local Government Area in Kaduna State, north-central Nigeria). These findings confirmed that intestinal helminthiasis is still a major problem in these Nigerian environments.

Group A subjects had an overall 12.8% prevalence of intestinal helminthes. Because the area of study is rural and endemic for intestinal helminthes, the helminthes found in this group were most likely due to reinfection after treatment. This prevalence is low compared with the overall 47.0% prevalence in group B; however, the low prevalence in group

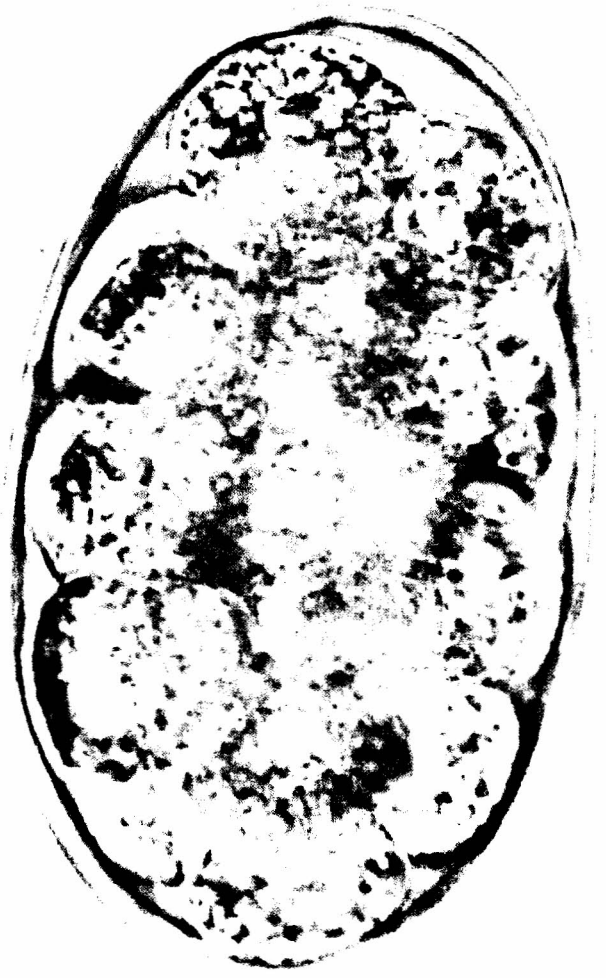

Image 1_Hookworm egg.

Table 3_Prevalence of Intestinal Helminth Infections in Relation to Subject Gender

	Group A		Group B	
Gender	No. Examined	No. Positive (%)	No. Examined	No. Positive (%)
Male	132	18 (13.6)	121	64 (52.9)
Female	118	114 (11.9)	129	55 (42.6)
Total	250	32 (12.8)	250	119 (47.6)

Table 2_Prevalence of Intestinal Helminthes in Relation to Subject Age in Groups A and B

	Group A		Group B				
Age Group (Years)	No. Examined	No. Positive (%)	No. Examined	No. Positive (%)	χ^2	P=0.000	Df=1
1-5	80	10 (12.5)	75	33 (44.0)	19.161	0.000	1
6-10	92	14 (15.2)	89	54 (66.7)	39.853	0.000	1
11-15	60	6 (10.0)	68	27 (33.9)	14.700	0.000	1
16-20	18	2 (11.1)	18	5 (27.8)	1.596	0.206	1

Image 2_*Strongyloides stercoralis* larva.

A could be attributed to the broad spectrum anti-helminth medication administered to the subjects of that group. These findings are in agreement with other studies, including those by Ejezie[10] and Nwokedi and colleagues.[11] The high prevalence of intestinal helminthes in group B could be a result of the students not being given anti-helminth medication before the collection of their samples for the study.

Table 4_Prevalence of Various Intestinal Helminthes in Dewormed and Non-Dewormed Subjects

Parasites	Group A, No. Positive (%)	Group B, No. Positive (%)
Hookworm	15 (41.7)	53 (33.5)
Ascaris lumbricoides	5 (13.9)	45 (28.5)
Schistosoma mansoni	9 (25.0)	8 (5.1)
Taenia solium	1 (2.8)	1 (0.6)
Strongyloides stercoralis	5 (13.9)	29 (18.4)
Trichuris trichiura	2 (5.6)	21 (13.3)
Total	36 (14.4)	158 (63.2)

Table 5_Frequency of Polyparasitism by Subject Age Group

	Group A		Group B	
Age Group (Years)	(n)	No. With Multiple Infections (%)	(n)	No. With Multiple Infections (%)
1-5	18	1 (5.56)	75	13 (17.3)
6-10	92	2 (2.17)	89	16 (18.0)
11-15	60	1 (1.67)	68	8 (11.8)
16-20	18	0 (0.00)	18	2 (11.1)
Total	250	4 (1.60)	250	39 (15.6)

The factors responsible for these findings may include poor environmental conditions, insufficient health care education, lack of toilet facilities, and lack of public health hygiene, coupled with the complete absence of pipe-borne water in the study area (the inhabitants have a complete dependence on ponds, rivers, and well water as their main sources of consumable water). There was a significant difference between the prevalence of intestinal helminthes in group A and group B ($P<0.05$).

The age group of 6- to 10-year-olds in study group B recorded the highest prevalence of 66.7%, which is similar to the findings of Ilesanumi[12] but differ with those of Meremikwu.[3] In group A, the same age group had a 12.5% prevalence, which is in accordance with a previous study by Jombo and colleagues.[13] The lowest prevalence was recorded in the age group of 16- to 20-year-olds, and this could be associated with a higher level of awareness of personal hygiene. In most places in Nigeria, people in these age groups would be in secondary school; some were said to have dropped out of school and after some time returned.

There was a significant difference between male and female prevalence in group A ($P<0.05$). This finding is similar to those of Nwokedi and colleagues[11] and Luka and colleagues.[9] The finding is the same with subjects in group B, and this finding is similar to those of Agwu,[2] Nwokedi and colleagues,[11] and Ilesanumi and colleagues,[12] who stated there were no significant differences in the prevalence of intestinal helminthes in their studies.

Hookworm had a prevalence of 46.9% and 32.8% in group A and B, respectively. These findings are higher compared with the prevalence of hookworm recorded by Agwu

(23.1%),[2] Meremikwu and colleagues (33.3%),[3] Nwokedi and colleagues (1.47%),[11] and Kogi and colleagues (14.4%).[14] *Ascaris lumbricoides* had a prevalence of 13.9% and 28.5% in groups A and B, respectively. These findings are higher compared with the results of Nwokedi and colleagues (0.5%)[11] and Luka and colleagues (0.9%),[9] possibly because the study was carried out in a rural area. *Strongyloides stercoralis* had a prevalence of 15.0% and 18.5% in groups A and B, respectively. This finding was higher than the 11.4% prevalence recorded by Luka and colleagues[9] and lower than the 27.5% prevalence recorded by Nwokedi and colleagues.[11] *Trichuris trichiura* had a 6.3% and 16.1% prevalence in groups A and B, respectively. This finding is higher compared with the 0.2% prevalence reported by Nwokedi and collegues[11] but lower than the 25.6% and 20% prevalences reported by Agwu[2] and Monstresor,[3] respectively.

There were generally higher parasite prevalences in group B than in group A. This is certainly because group A subjects were given anti-helminth medications before the study. The prevalence of *Schistosoma mansoni* and *Taenia spp.* in both groups were similar, and this confirmed the fact that the anti-helminthes administered had no effect on trematodes and cestodes. This study also recorded multiple infections, as reported by previous studies.[4,9,14] Multiple infections appear to be the norm in many Nigerian communities. This may be because an already-established parasite, through its activities, may create an environment within the host that will be suitable for other parasites.[15-17] This study reveals that regular use of broad-spectrum anti-helminth medication is advocated for an effective deworming program. LM

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