

## Prevalence and predisposing factors regarding intestinal parasitic infections among rural primary school pupils at Minia Governorate, Egypt

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### Abstract

About 400 million school-age children are infected with roundworm, whipworm and hookworm worldwide. This study aims to assess prevalence of parasitic infections among rural primary school pupils at Minia Governorate, Egypt, and to identify relevant predisposing factors of the school and pupils to intestinal parasitic infections. A total of 264 pupils out of 1,053, aged 6-12 years, were randomly selected for parasitological investigation and the school was inspected on site for sanitary facilities and conditions of hygiene, as well as the conditions of hygiene of the pupils. The pupils were examined for ova, cysts and/or larvae of intestinal parasites using direct wet mount and formal-ether concentration techniques. Inspection of sanitary facilities and the conditions of hygiene of the school, as well as pupil's conditions of hygiene, were carried out through observation checklists. Findings revealed the following intestinal parasites: *Entamoeba coli* (in 19.3% of pupils), *Ascaris lumbricoides* (3.8%), *Hymenolepasis nana* (12.5%), *Enterobius vermicularis* (5.7%) and *Giardia lamblia* (12.5%), with varying percentages between male and female pupils, and a highly statistical association between pupil sex and type of parasites ( $P < 0.001$ ). Unapproved sanitary facilities and conditions of hygiene of the school and pupils were observed. Many intestinal parasitic infections among the primary school pupils were found. Unapproved and low inventory school sanitary facilities were observed, in addition to poor conditions of hygiene of pupils which may play a crucial role in these infections. The school facilities and sanitary conditions, especially the quality of water in the toilets, should be improved. Pupils and school personnel have a real need for health education about modes of transmission and preventive methods of intestinal parasitic infections.

### Introduction

Intestinal parasitic infections still constitute

one of the major causes of public health problems in the world, particularly in developing countries.<sup>1,2</sup> Helminths or worm infestations refer to worms that live as parasites in the human body and are a fundamental cause of disease associated with health and nutrition problems beyond gastrointestinal tract disturbances.<sup>2</sup> Globally, over 3.5 billion people are infected with intestinal worms, of whom 1.47 billion are infected with roundworm, 1.3 billion people with hookworm and 1.05 billion with whipworm.<sup>1</sup> Intestinal parasitic infections have been a major public health problem in Palestine over the last ten years (2000-2009). Prevalence of these parasites varies from one Arabian country to another. In the Middle East, for instance, reports on intestinal parasites have shown prevalence rates of 28.7% in Yemen, 19.3-27.3% in Iran, 12.4% in Lebanon, 16.6-74.6% in the Gaza Strip (Palestine), 28.5% in Jordan, 42.5% in Syria, 31.4-32.2% in Saudi Arabia, 17.0-90.4% in Sudan, 33.9% in Qatar, 31.8-37.2% in Turkey, and 27% in Egypt.<sup>3</sup> There are many reasons for the difference in prevalence of infections in these countries such as geographic and socio-economic factors, climate, poverty, malnutrition, personal and community hygiene, population density, unavailability of drinking water and poor sanitary facilities.

About 400 million school-age children around the world are infected with roundworm, whipworm and hookworm.<sup>4</sup> Intestinal parasitic infections are endemic and have been described as the greatest single worldwide cause of illness and disease.<sup>5-7</sup> Worm infestation is a major problem in children from developing countries. Intestinal parasitic infections are most common among school-age children and tend to be of high intensity in school-age children.<sup>1,6</sup> The highest infection rate and worm burden were found among school children aged 5-15 years and were attributed to poor sanitation and hygiene. These infections can affect child development, educational achievement, reproductive health, and social and economic development.<sup>7</sup> Children are among the most vulnerable to environmental threats as they are in a dynamic state of growth with their cells multiplying fast and their organ systems developing at a rapid rate.<sup>8</sup> These parasites consume nutrients from the children they infect, thus retarding their physical development. They destroy tissues and organs, cause abdominal pain, diarrhea, intestinal obstruction, anemia, ulcers and other health problems. All of the consequences of infection can slow cognitive development and thus impair learning. It produces nutritional deficiencies and anemia in children, especially when hookworm infestation is present.<sup>9,10</sup> Reports from the WHO and others of the international community show that

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there is real potential for improving child health and creating a better future for the coming generations through scaling up action to confront environmental dangers.<sup>8,10,11</sup> The present study was conducted to assess prevalence of intestinal parasitic infections among rural primary school pupils at Minia Governorate and to identify relevant predisposing factors of the school and pupils regarding intestinal parasitic infections.

### Materials and Methods

A cross-sectional design was utilized in this study. The study was conducted in a Damaries rural primary school in Minia Governorate between mid-February 2009 to mid-May 2009 (2nd semester of the academic year 2008/2009). Minia Governorate is one of the Upper Egypt Governorates, 247 km from Cairo. The study was carried out with the permission of the school authorities. A total of 264 pupils out of 1,053 aged 6-12 years were randomly selected for parasitological investigation and the school was inspected on site to evaluate sanitary facilities and conditions of hygiene, as well as conditions of hygiene of the pupils. Additional pupils' personal data information were collected including name (code), age, sex, parents' level of education and occupation, and any physical complaints pertinent to the study of the pupil at the time of data collection. Afterwards, the randomly selected pupils were each given a clean, dry, well-labeled specimen bottle in which to deposit their fecal samples. The procedure for introducing fecal material into the bottles was explained and demonstrated to pupils by the researcher and class teachers. Fecal samples were collected and transported to the laboratory for analysis. The

**Table 1. Socio-demographic characteristics of the study sample (n=264 pupils).**

	Variable	N	%
Sex	Male	93	35.2
	Female	171	64.8
Age	≤ 6-8 years	63	23.9
	≤ 9-12 years	201	76.1
	Mean ± SD		8.85±1.18
Father's level of education	Illiterate	192	72.7
	Can read and write	0	0
	Diploma	72	27.3
	University	0	0
Father's work	Manual	212	80.3
	Professional	52	19.7
Mother's level of education	Illiterate	218	81.8
	Can read and write	0	0
	Diploma	48	18.2
	University	0	0
Mother's work	Manual	240	90.9
	Professional	24	9.1

**Table 2. Pupils' physical complaints pertinent to the study at the time of data collection according to pupils' sex.**

Type of physical complaint	Male (n=93)	Female (n=171)
	N / %	N / %
Diarrhea	12(14.8)	108(63.2)
Abdominal colic	48(51.6)	126(73.7)
Mucous in stool	24(25.8)	0(0)

**Table 3. Description of school's facilities and sanitary conditions of the study sample.**

	Variable/Alternatives	Numbers/Response
Type of toilet	Pit latrine	Present
	Flush toilet	Present
	N. toilet/latrine	12
	N. functional toilet	9
Toilet and latrine / pupil ratio	1053:12=1:88 pupil approximately	
School source(s) of water	Tap water	Only tap water
	Well	
	Storage tank	
	N. water sources available	
Location of refuse dumps within premises	Approved	Approved
	Unapproved	
General cleanliness of school	Very neat	Neat
	Neat	
	Dirty	
	Very dirty	
Toilet / latrine conditions of cleanliness	Very neat	Dirty
	Neat	
	Dirty	
	Very dirty	
Availability of water	Available	Unavailable (cut off)
	Unavailable	
Availability of soap or disinfectant solution to wash hands	Available	Unavailable
	Unavailable	
Sewage disposable condition	Approved	Unapproved
	Unapproved	
Toilet/latrine floor cleanliness condition	Very neat	Dirty
	Neat	
	Dirty	
	Very dirty	

pupils were examined for ova, cysts and/or larvae of intestinal parasites using the direct wet mount and formal-ether concentration techniques. Inspection of sanitary facilities and conditions of hygiene of the school, as well as conditions of hygiene of the pupils, were carried out through observation checklists. The inventory of sanitary facilities within the school premises was also assessed through an observational checklist. Observation on site of the school premises was also conducted to ascertain the state of cleanliness of the school environment and sanitation at the time of data collection. These on site observations evaluated: toilet/latrine cleanliness and conditions, availability of water, availability of soap or disinfectant solution to wash hands, sewage disposal system, and cleanliness and condition of the floors. The observational checklist of the school was applied three times randomly over the period of data collection. The observational checklist of the conditions of hygiene of the pupils included: observation of general hygiene and grooming, condition and cleanliness of hands and finger nails, and hand washing after defecations, as well as the sharing of underwear with other siblings. Data were collected, coded and analyzed using a descriptive statistical method, in addition to measures of association; Eta2 aided with the computer based Statistical Package for Social Sciences (SPSS).

## Results

Table 1 shows the socio-demographic data of the study sample. Out of 264 randomly selected pupils, 93 were males and 171 females. Age ranged from six to 12 years and more than three-quarters of the pupils were aged 9-12 years (76.1% of pupils), with a mean score of 8.85±1.18. The majority of the pupils' parents were illiterate (72.7% of fathers and 81.8% of mothers). Also, the majority of pupils' parents were manual workers (80.3% of fathers and 90.9% of mothers).

Table 2 shows the physical complaints pertinent to the study presented by the pupils at the time of data collection according to pupils' sex. Findings show the presence of some pertinent physical complaints among both males and females. One of the complaints was diarrhea which was presented by 14.8% and 63.2% of males and females, respectively, while abdominal colic was presented by 51.6% and 73.7% of males and females, respectively. Mucous in the stool was observed in only 25.8% of male pupils. None of the pupils in the present study suffered from blood in the urine, blood in the stool or fever.

Table 3 describes the facilities and sanitary conditions of the school. Twelve pit latrines

and flush toilets were found on the school premises; 9 of them were functioning and the toilet and latrine to pupil ratio was 1:88 approximately. The only source of water at the school was tap water. The location of refuse dumps within the school premises corresponded to that approved. As far as the general cleanliness of school is concerned, the school was neat. Meanwhile, the toilets and latrines were found to be dirty and there was no water; this had been cut off. Also there was no soap or disinfectant solution available. The facilities for sewage disposal had, therefore, not been approved and the floor of the toilets and latrines was dirty.

Table 4 shows pupils' conditions of hygiene according to the pupils' sex. The findings showed that less than half of male and female pupils met the approved standards of general conditions of hygiene and personal grooming (43% and 40.9%, respectively). Only 12.9% and 42.1% of male and female pupils, respectively, were in the habit of washing vegetables by themselves. Only a minority kept their hands and the nail bed clean. None of the pupils washed their hands after defecation for the sample. Most of them shared underwear with their siblings.

Five intestinal parasites were found among

the study sample; percentages differed between male and female pupils (Table 5). *Entamoeba coli* accounted for 19.3% of pupils; 22.6% of males and 11.7% of females. *Ascaris lumbricoides* accounted for 3.8% of pupils; 3.2% of males and 4.1% of females. *Hymenolepis nana* was recorded in 12.5% of pupils; 11.8% of males and 1.3% of females. *Enterobius vermicularis* was observed in 5.7% of the fecal samples examined; 4.3% of males and 6.4% of females. *Giardia lamblia* was found in 12.5% of the fecal samples examined; 15.1% of males and 11.1% of females. A highly significant statistical association between pupil sex and type of parasite was found ( $P < 0.001$ ).

## Discussion

This study identified the prevalence of intestinal parasitic infections (19.3%, 3.8%, 12.5%, 5.7% and 12.5%) for *Entamoeba coli*, *Ascaris lumbricoides*, *Hymenolepis nana*, *Enterobius vermicularis* and *Giardia lamblia*, respectively, in school pupils. These findings were in line with similar studies conducted in Nigeria. The reasons for this prevalence may

be attributed to poor environmental conditions and personal hygiene, an inadequate supply of drinking water, and a waste disposal system which does not correspond to approved standards.<sup>10-12</sup> There was a highly statistical association between pupil sex and type of parasite in the present study. Authors recorded higher infection rates in males and reasoned that this was a result of gender differences in recreational activities.<sup>13-15</sup>

The study observed that sanitary facilities in the school were inadequate and this is of epidemiological significance considering the number of hours pupils spend in school. The ratio of the number of pupils per toilet far exceeds that recommended.<sup>12</sup> Furthermore, the lack of available water within the school premises, combined with the factors discussed above, exacerbated the risk of infection. This widespread contamination of the school environment with pathogenic organisms underscores the importance of correct and appropriate disposal of waste in the protection and promotion of sustainable health. The provision of adequate sanitary facilities in school could interrupt transmission of fecal-oral pathogens. Epidemiological evidence suggests that improvement of sanitation and community hygiene, along with improvements in water supply, have a considerable impact in reducing communicable diseases.<sup>16,17</sup> The absence of drinking water in schools may drive pupils to other unhygienic sources, thereby increasing risk. The school environment offers an ideal terrain for intervention activities aimed at controlling intestinal parasitic diseases and elimination of potential risks. Provision of adequate toilet facilities that children are trained to use and are happy to use will certainly discourage indiscriminate defecation elsewhere. The outcome of this study underscores the urgent need for provision and improvement of sanitary facilities in schools. Consistent intervention strategies should be targeted at the parasites by way of environmental sanitation through provision of sanitary facilities and adherence to personal hygiene ethics through health education.<sup>18,19</sup>

These will go a long way in reducing the scourge of intestinal parasitic infections in pupils. The involvement of parents and other stakeholders in designing and implementing these interventions is fundamental to their success.

**Table 4. Distribution of pupils' conditions of hygiene according to sex (n=264).**

Variables	Male		Female	
	N.	%	N.	%
General hygiene /grooming				
Approved	40	43	70	40.9
Unapproved	53	57	101	59.1
Wash vegetables by herself/himself				
Yes	12	12.9	72	42.1
No	81	87.1	99	57.9
Cleanliness of hands and nail beds				
Clean	24	25.8	24	14
Unclean	69	74.2	147	86
Hands washed after defecation for the sample				
Yes	0	0	0	0
No				
Share underwear with other siblings				
Yes	69	74.2	138	80.7
No	24	25.8	33	19.3

**Table 5. Prevalence of intestinal parasitic infections according to pupils' sex (total n=264).**

Variables	Male (n=93)		Female (n=171)		Total both sexes		Measures of association Eta <sup>2</sup>
	N.	%	N.	%	N.	%	
<i>Entamoeba coli</i>	21	22.6	20	11.7	51	19.3	0.004
<i>Ascaris lumbricoides</i>	3	3.2	7	4.1	10	3.8	0.000
<i>Hymenolepis nana</i>	11	11.8	22	1.3	33	12.5	0.000
<i>Enterobius vermicularis</i>	4	4.3	11	6.4	15	5.7	0.002
<i>Giardia lamblia</i>	14	15.1	19	11.1	33	12.5	0.003

\*Highly significant statistical association.

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