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## THE EFFECT OF PARASITIC INFESTATION ON SCHOOL ACHIEVEMENT AMONG PRIMARY SCHOOL CHILDREN IN HEHIA CENTER, EGYPT

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### ABSTRACT

Background: Intestinal parasitic infestations are one of the neglected tropical diseases and it is the most common among school children. It negatively affects children's growth, cognitive development and learning abilities. It may lead to nutritional deficiencies and anemia. Objective: to identify the effect of parasitic infestations on the school achievements among primary school children. Methods: Descriptive comparative design was conducted on a sample of 200 children (100 infected study group, and 100 not infected) at Hehia primary schools, Sharkia Governorate, Egypt. Two tools were used; A questionnaire interview sheet and A student performance assessment form. Results: 65% of infected children were males particularly in families with a large size (their crowding index was >1.5). School children of unemployed parents and/or parents with a low educational level were at higher risk of contracting parasitic infections. There was a statistically significant difference between both the infected and non-infected groups concerning the educational achievement domains. Conclusion: All of the studied parasitic infected children had lower school achievements.

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### Introduction

The objective of the work is to identify the effect of parasitic infestations on school achievements among primary school children. Children are the vulnerable group in the community, their health is vital to the future of the society. School age is a segment of life span that extends from age 6- 12. School children are the main target to many health problems such as malnutrition, non-infectious diseases and infectious diseases as intestinal parasitic diseases [1].

Gastrointestinal parasites are micro-organisms that live in the intestine, some cause problem while others can live for long periods in the bowel without causing any symptoms or requiring any treatments.

Gastrointestinal parasite and severity of its infections have a profound impact on human public health and development, affecting approximately one-third of the world's population, causing high mortality rate mostly in children. They can be largely categorized into two groups, protozoans (e.g. Entamoebahistolytica, Giardia duodenalis) and helminthes (e.g. Ascarislumobricoides). These GIPs flourish in settings characterized by a warm temperature, humidity, poor sanitation, dirty water and crowded housing [2].

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[3] mentioned that in developed countries, protozoan parasites more commonly cause gastrointestinal infections compared to helminthes. As well, WHO estimates, at least 2 billion people worldwide are infected with helminthes, and of these approximately 300million suffer from associated severe morbidity [4].

The public health impact of parasitic infection has been consistently underestimated in the past, but there is now a general consensus that diseases caused by intestinal parasites represent an important public health problem, especially in children. Recent studies have suggested that even moderate intensity of infection may have adverse effects on growth, iron deficiency anemia and cognitive function, practically for children of the school age [5].

These adverse health consequences combine to impair childhood educational performance, reduce school attendance and subsequent productivity; also, these affect their physical development and may also prevent them from taking full advantage of their opportunity for formal school education [6].

Fortunately, parasitic infestations are preventable thus pediatric health care providers can play an important role in prevention, early detection and management of parasitic infection and its complications [7].

Also, school health nurses have an important role in the prevention and control of parasitic diseases. They educate children, and train them on their care and about personal hygiene measures such as: keeping finger nails short, avoiding scratching of perianal area, and nail biting. Washing their hands as a good hand hygiene is the most effective preventive measure especially after using the bathroom and before eating, as well, avoiding sucking thumbs, especially for Ascariasis is effective. Moreover, the school health nurses encourage children to wear shoes and avoid going barefoot, especially for Ancylostoma duodenal [1]. The findings of this study might help in strengthening the information available so far, and encourage policy makers to design effective strategies to prevent intestinal parasitic infections in the study area.

## Materials and Methods

### Research design:

Descriptive comparative design was used to identify the effect of parasitic infestations on school achievements among primary school children.

### Study Setting:

The study was conducted at Hehia primary schools, Sharkia Governorate, Egypt. A total of 25 schools. Three schools were randomly selected to conduct the current study.

### Study Subjects:

The subjects of this study were composed of two main groups:

#### Group I: Study group:

100 children were recruited according to the following criteria constituted the sample:

Age: from 6-12 years.

Both sexes.

Free from any other diseases except complications of parasitic infections.

#### Group II: Control group:

Matching sample of healthy children of the current study composed of 100 primary school children, who met the inclusion criteria,

Age: from (6 to 12)

Both sexes (male &female)

Free from any parasitic diseases, infections, injury and deformity.

### Tools for data collection

Two tools were used in this study:

#### Tool I: A structured interview questionnaire:

A structured interview questionnaire was developed by the researchers after reviewing relevant scientific literature and articles to collect the required data. It consisted of the following parts:

##### Part A:

Personal characteristics of studied children.

##### Part B:

Parents' characteristics of the studied school children.

##### Part C:

Medical history of the disease among the studied school children.

#### Tool II: Student Performance Assessment Form [8]:

The scale was used to assess school achievements of the students by their teachers. This scale was modified and translated into Arabic by the researcher. Modifications were done in Creativity and Ability parts to concentrate more on these domains. The responses are on a six-point scale: no comment, never, seldom, sometimes, often and always. It consists of 5 domains as:

Learning Motivation/ Attitude included (4 items).

Learning Characteristics included (4items).  
 Behavioral Performance in class included (6 items).  
 Creativity included (5 items).  
 Ability to concentrate included (23 items).

**Field work:**

Upon securing all official permissions, the process of data collection was started from October 2016 to January 2017. The researcher first introduced herself and explained the purpose of the research briefly to all the children who were not infected and infected by parasitic infestations. Each child was interviewed individually in the class. After giving the explanation of the purpose of the study and taking their oral consent, the researcher read each item of the study questionnaire to them. The time consumed for answering the study questionnaire ranged from 20-30 minutes. The researcher performed the fieldwork three days weekly (Saturday, Monday and Wednesday).

Whether the child was infected by parasite or not was determined by revising school health records. That was based on annual parasitic infestations' screening done by the ministry of health for all Egyptian schools.

**Administrative Design:**

An official request to conduct the study was directed from the faculty of Nursing, Zagazig University to the directors of three primary schools at Hehia city. It was done by obtaining an official permission from the directors of schools in which the study would be conducted.

**Ethical considerations:**

Written informed consents were obtained from the students and their parents. Oral permission was obtained from the teacher before interviewing with the students in the class.

**Statistical analysis:**

Collected data were coded, computed and statistically analyzed using SPSS (statistical package of social sciences), version 16. Data were presented as frequency and percentages (qualitative variables) and mean ± SD (quantitative continuous variables). Chi square (χ<sup>2</sup>) was used for comparison of categorical variables, and was replaced by Fisher exact test (FET) or Mont Carlo Exact test if the expected value of any cell was less than 5. Student's t test was used for comparison of continuous quantitative variables (two groups), and one way anova (F test) was used for comparison of the continuous quantitative variables (more than two groups). For continuous quantitative variables which were not normally distributed, median was used as a central tendency measure, and Mann Whitney test (Z) was used for comparison of two groups. The difference was considered significant at P ≤ 0.05.

**Results**

Table (1) reveals that the mean age of the two groups (infected and not infected) was 7.73 ± 1.50 years of age. The same table illustrated that 50% of the non-infected group were males; compared to 65% of the infected group. Regarding the crowding index, it was found that 92% of non-infected group had crowding index up to 2 compared to 68% of the infected group.

Concerning the mothers' education, it was found that 43% and 18%, of non-infected and infected groups' mothers, respectively, had finished their university education level, this is shown in table (2). Also, it was found that 59% & 74% of both groups' mothers were not working. As for fathers' education, the groups' fathers had university education level presented by 47% and 18%, respectively.

Table (3) demonstrates that 92% of these diseases were intestinal parasites mainly of infected group. It also revealed that 65% of infected group had positive school results compared to 28% of not infected group. There was 66% of infected group that had parasitic infection in their family compared to 34% of not infected group. As that infection mainly from brothers and sisters in both infected group and non-infected group was represented by 49% & 16%, respectively.

Table (4) shows that there was a statistical significant difference between infected and non-infected students regarding all healthy behaviors (p < 0.05).

Table (5) shows that 8% of the non-infected group had poor performance compared to 36% of the infected group. Also, table (6) shows that there was a statistically significant difference between both infected and non-infected group concerning the educational performance domains (p < 0.05).

Table 7 demonstrates that a statistically significant difference was found between the child's age and the average educational performance score in infected group (P= 0.037). Also, a statistically significant difference was found between the child's gender and average educational performance score in infected group. (P= 0.008).

**Table 1: Characteristics of the Studied School Children**

Characteristics	Not Infected (100)		Infected(100)		Significance test
	No	%	No	%	
<b>Age/years</b>					
6	41	41.0	42	42.0	χ <sup>2</sup> = 1.382 P 0.710
• 7	3	3.0	1	1.0	
• 9	54	54.0	56	56.0	

• 10	2	2.0	1	1.0	
<b>Mean ± SD</b>	7.73 ± 1.50		7.73 ± 1.50		-----
<b>Sex</b>					
• Males	50	50.0	50	65.0	$\chi^2 = 4.604$ P 0.032*
• Females	50	50.0	50	35.0	
<b>Birth order</b>					
• 1 <sup>st</sup>	41	41.0	36	36.0	$\chi^2 = 7.972$ P 0.047*
• 2 <sup>nd</sup>	39	39.0	35	35.0	
• 3 <sup>rd</sup>	12	12.0	26	26.0	
• 4 <sup>th</sup> &plus	8	8.0	3	3.0	
<b>School grade</b>					
• 1st	43	43.0	43	43.0	$\chi^2 = 3.009$ P 0.390
• 2nd	2	2.0	0	0.0	
• 3rd	0	0.0	1	1.0	
• 4 <sup>th</sup>	55	55.0	56	56.0	
<b>Family number</b>					
• 3	10	10.0	6	6.0	$\chi^2 = 9.653$ P 0.047*
• 4	43	43.0	27	27.0	
• 5	31	31.0	47	47.0	
• 6	15	15.0	20	20.0	
• 7	1	1.0	0	0.0	
• <b>Mean ± SD</b>	4.54 ± 0.90		4.81 ± 0.81		t=2.207, P0.028*
<b>Crowding Index</b>					
• Up to 2	92	92.0	68	68.0	$\chi^2 = 17.910$ P 0.000*
• >2	8	8.0	32	32.0	
<b>Mean ± SD</b>	1.69 ± 0.42		2.01 ± 0.47		t=4.937, P0.000*

**Table 2:** Parents Characteristics of the Studied School Children

Characteristics	Not Infected (100)		Infected (100)		Significance test
	No	%	No	%	
<b>Mothers' age /years</b>					
• <30 years	47	47.0	38	38.0	$\chi^2 = 1.657$ P 0.198
• ≥ 30	53	53.0	62	62.0	
<b>Mothers' education</b>					
• Illiterate	13	13.0	34	34.0	$\chi^2 = 19.955$ P 0.000*
• Basic	13	13.0	16	16.0	
• Secondary	31	31.0	32	32.0	
• University	43	43.0	18	18.0	
<b>Mothers' job</b>					
• Working	41	41.0	26	26.0	$\chi^2 = 5.050$ P 0.025*
• Not working	59	59.0	74	74.0	
<b>Fathers' age</b>					
• <30 years	39	39.0	22	22.0	$\chi^2 = 6.817$ P 0.009*
• ≥ 30	61	61.0	78	78.0	
<b>Fathers' education</b>					
• Illiterate	7	7.0	21	21.0	$\chi^2 = 23.601$ P 0.000*
• Basic	17	17.0	30	30.0	
• Secondary	29	29.0	31	31.0	
• University	47	47.0	18	18.0	
<b>Fathers' job</b>					
• Employed	63	63.0	36	36.0	$\chi^2 = 14.581$ P 0.000*
• Others	37	37.0	64	64.0	
<b>Time spent with children</b>					
• Long	73	73.0	45	45.0	$\chi^2 = 16.205$ P 0.000*
• Short	27	27.0	55	55.0	

**Table 3.** Medical History of the Disease among the Studied School Children

Items	Not Infected (100)		Infected (100)		Significance test
	No	%	No	%	
<b>Suffering from any disease</b>					
• Yes	27	27.	97	97.	$\chi^2 = 104.007$ P0.000*
• No	73	73.	3	3.0	
<b>Types of diseases</b>					
• Tonsillitis	13	13.	26	26.00	$\chi^2 = 5.380, P 0.020^*$
• Otitis media	12	12.	7	7.0	
• Intest. parasites	1	1.0	92	92.	$\chi^2 = 166.4, P0.000^*$
• Cold	6	6.0	10	10.	
• Nocturnal Enuresis	2	2.0	7	7.0	$\chi^2 = 2.911, P0.089$
<b>Doing stool analysis</b>					
• Yes	78	78.	87	87.	$\chi^2 = 2.805$ P 0.094
• No	22	22.	13	13.	
<b>Its results</b>					
• Negative	50	50.	23	23.	$\chi^2 = 24.19$ P 0.000*
• Positive	28	28.	65	65.	
<b>Taking treatment</b>					
• Yes	29	29.	61	61.	$\chi^2 = 45.14$ P 0.000*
• No	49	49.	27	27.	
<b>Parasites in family</b>					
• Yes	19	19.	66	66.	$\chi^2 = 5.050$ P 0.025*
• No	81	81.	34	34.	
<b>Whom?</b>					
• Father	0	00.	2	2.0	FET, P 0.249 $\chi^2 = 4.030, P 0.044^*$ $\chi^2 = 24.820, P0.0^*$
• Mother	3	3.0	10	10.	
• Brothers/sisters	16	16.	49	49.	

**Table 4.** Healthy Behaviors of the Studied School Children

Characteristics	Not Infected (100)		Infected (100)		Significance test
	No	%	No	%	
<b>Hand washing before &amp; after eating</b>					
• yes	93	93.0	55	55.0	$\chi^2 = 37.526$ P 0.000*
• No	7	7.0	45	45.0	
<b>Hand washing after toilet</b>					
• Yes	89	89.0	44	44.0	$\chi^2 = 45.449$ P 0.000*
• No	11	11.0	56	56.0	
<b>Good washing the fruits &amp; vegetables</b>					
• yes	85	85.0	41	41.0	$\chi^2 = 41.527$ P 0.000*
• No	15	15.0	59	59.0	
<b>Eating from street vendors</b>					
• Yes	44	44.0	80	80.0	$\chi^2 = 27.504$ P 0.000*
• No	56	56.0	20	20.0	
<b>Presence of sewage system in the house</b>					
• Yes	99	99.0	87	87.0	FET, P 0.001*
• No	1	1.0	13	13.0	
<b>Presence of water taps in the house</b>					
• Yes	99	99.0	84	84.0	FET, P 0.000*
• No	1	1.0	16	16.0	
<b>Wearing shoes outside home</b>					
• Yes	94	94.0	52	52.0	$\chi^2 = 44.749$ P 0.000*
• No	6	6.0	48	48.0	

**Table 5.** Student performance score of the studied children.

Educational performance	Not infected		Infected		Significance Test
	No	%	No	%	
Poor performance	8	8.0	36	36.0	$\chi^2 = 34.052$ , P 0.000*
Moderate performance	64	64.0	59	59.0	
Good Performance	28	28.0	5	5.0	

Significant at  $\leq 0.05$

**Table 6.** Average means score of educational domains in both groups

Characters	Not Infected (100)	Infected (100)	Significance test
	Mean $\pm$ SD	Mean $\pm$ SD	
1-Learning Motivation/Attitude	14.35 $\pm$ 4.14	10.22 $\pm$ 4.73	t= 6.575, P0.000*
2-Learning Characteristics	14.30 $\pm$ 3.59	10.22 $\pm$ 4.33	t= 7.254, P0.000*
3-Behavioral performance in Class	23.78 $\pm$ 4.22	18.71 $\pm$ 6.21	t= 6.750, P0.000*
4- Creativity	15.63 $\pm$ 4.95	11.43 $\pm$ 5.04	t= 5.948, P0.000*
5-Concentration Ability	75.22 $\pm$ 13.96	64.11 $\pm$ 13.08	t= 5.809, P0.000*
Total educational performance score	143.28 $\pm$ 24.22	114.69 $\pm$ 28.76	t= 7.617, P0.000*

**Table 7.** Relationship between average educational performance score of the studied children about parasitic infestation and their personnel characteristics

Characters	Not infected		Infected	
	No	Mean $\pm$ SD	No	Mean $\pm$ SD
<b>Age</b>				
6 and 7 years	44	142.70 $\pm$ 22.87	43	107.84 $\pm$ 26.56
9 and 10 years	56	143.73 $\pm$ 25.43	57	119.86 $\pm$ 29.35
Significance test	t = 0.210, P 0.834		t = 2.112, P 0.037*	
<b>Sex</b>				
Males	50	142.68 $\pm$ 23.15	65	109.18 $\pm$ 26.84
Females	50	143.88 $\pm$ 25.47	35	124.91 $\pm$ 29.54
Significance test	t = 0.247, P 0.806		t = 2.698, P 0.008*	
<b>Child Order</b>				
1 <sup>st</sup>	41	145.95 $\pm$ 24.51	36	117.53 $\pm$ 31.82
2 <sup>nd</sup>	39	142.05 $\pm$ 22.86	35	118.80 $\pm$ 23.38
3 <sup>rd</sup>	12	134.92 $\pm$ 28.38	26	106.88 $\pm$ 30.17
4 <sup>th</sup> plus	8	148.12 $\pm$ 23.71	3	100.33 $\pm$ 27.64
Significance test	F = 0.778, P 0.509		F = 1.260, P 0.293	
<b>Child class</b>				
1 <sup>st</sup> and 2 <sup>nd</sup>	45	142.56 $\pm$ 22.63	43	107.84 $\pm$ 26.56
3 <sup>rd</sup> and 4 <sup>th</sup>	55	143.87 $\pm$ 25.64	57	119.86 $\pm$ 29.35
Significance test	t = 0.269, P 0.788		t = 2.112, P 0.037*	
<b>Family Number</b>				
3	10	149.40 $\pm$ 21.97	36	119.50 $\pm$ 29.39
4	43	146.12 $\pm$ 19.45	35	117.11 $\pm$ 26.01
5	31	138.94 $\pm$ 27.57	26	112.91 $\pm$ 30.38
6 or 7	16	140.25 $\pm$ 30.10	3	114.15 $\pm$ 29.51
Significance test	F = 0.821, P 0.486		F = 0.178, P 0.911	
<b>Crowding Index</b>				
Up to 2/ room	92	142.07 $\pm$ 22.44	65	111.54 $\pm$ 28.31
More than 2/ room	8	145.10 $\pm$ 26.86	35	116.53 $\pm$ 28.94
Significance test	t = 0.612, P 0.542		t = 0.840, P 0.403	

## Discussion

"School-age" is very crucial for the development of the healthy habits, lifestyle and behavior, therefore, an important joint venture of the departments of education and health provides an opportunity to implement primary and secondary prevention at the same time to a large number of children [9].

[10] stated that the students' achievements measure the amount of academic content students learn in a determined amount of time. Each grade level has learning goals or instructional standards that educators are required to teach.

Parasites are organisms that are dependent upon a particular species of host and may be seen either macroscopically (by the naked eye) or with the aid of a microscope (microscopically). As well, the parasite depends upon the host for its nutrients,

and the true parasites obtain their nutrients at the expense of the host. Some parasites of humans cause little or no physical harm, whereas others cause severe diseases and death [11].

Regarding the characteristics of studied school children, the current study mentioned that more than half of the studied groups were at the age of 9 to less than 10. These results were supported by [12] who revealed that the overall infection rate was the highest among 9 years' age group. On the other hand, this result is in contrast with the study conducted in Morocco who showed that the age distribution of the prevalence of infection rate was the highest among the children aged more than 10 [13]. Also, these findings disagreed with [14] who found that the association of age with infection was not significant; and all the age groups were almost equally exposed. These may be due to the reason that this age had more activities in contact with water and earth. Regarding the sex of the studied children, the present study showed that the majority of infected children were males. The difference in parasitic infections between the sexes, that is higher in males than females could be due to the modes of the transmission of the parasites, sample size determination, study population and the methods used which could be attributed to this observed difference in the detections of various parasites. These results disagreed with [15] who found that, the higher infection prevalence was in females than males. These results are in agreement with [16] who found that males were more affected than females.

[17] reported that about a half of the studied students had previous history of parasitic infection, that matched with the present study which revealed that more than three quarters of the studied students suffered from a previous disease mainly parasitic infection. This may be due to not fully developed immune systems among school children in addition to their means of playing and poor hygiene practices which put them at the frequent risk of infection. Also, these results were in agreement with the study done in Tanta by [18] who demonstrated that about one quarter of school pupils had previous intestinal parasitic infections.

The present study showed that the majority of the studied children didn't wash their hands after and before eating or after defecation. This is probably due to the low knowledge of the children mainly about the faecal-oral transmission of intestinal parasites through their unwashed hands, or perhaps, due to the lack of hand washing facilities close to lavatory. This result matched with [19] who reported that the majority of the studied children hadn't washed their hands after defecation. And also with [20] who postulated that intestinal parasites spread through poor hygienic practices, evidenced by contaminated finger nails and unclean hands. Regarding the educational performance among the student children, there was statistically a significant difference between both groups. These findings were in accordance with [21] who stated that helminthes associated infection may have adverse effects on the educational performance of the school children. Also, these findings were supported by [14] who mentioned that pathogenic protozoan infections were known to cause gastrointestinal problems of varying severities and outcomes. These results may be due to the reason that the school aged children with parasitic infestations became unable to attend school due to diarrhea or severe abdominal pain, consequently leading to the low academic performance. Also, this result was in agreement with the results of a previous study conducted by [22] who showed that when the prevalence of the infestation increases, the school achievement decreases. It may be due to the fact that severe infestation may cause anemia and also uncomfortable night sleeping, which may have an effect on the child's concentration and achievement. In the current study, a statistically significant relation between the prevalence of the infestation and the students' performances among the studied children was found. These results matched with [23] who studied the impact of nutrition, helminth infection, and the lifestyle on the elementary school students' achievements, and found out a statistically significant difference between the parasites-infected group and non-infected group in the students' achievements.

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