

Enterobiasis among Pre-School Children in Gaza Strip, Palestine.

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Abstract: Background: *Enterobius* is one of the common nematode causing health problem in developing countries. The aim of the present study was to estimate the prevalence of *Enterobius vermicularis* in Gaza Strip.

Methods: This is a cross-sectional study which included 149 pre-school children who are residing in four Governorates in Gaza Strip; north Gaza, Gaza, mid zone and Khanyounis in Gaza Strip. Scotch tape preparation (STP) was used for the detection of *E.vermicularis* eggs.

Results: Children with employee father had high prevalence of *E. vermicularis* with a percentage of (47.3%) while those with un-employee father had a percentage of (45.7%) but there was no significant difference. The same results were found with working mother. Families with low family income had children with low rate of *E. vermicularis* (40.5%) but families with high family income had children with high rate of *E. vermicularis* (52.8%). Children who are drinking water from filters had high rate of *E. vermicularis* than others who are drinking from other sources (65%) with a significant difference ($p=0.003$).

Conclusion: The study concluded that enterobiasis constituted a high prevalence among pre-school children in Gaza strip (46.3%). These results may shed the light on an infectious disease in Gaza Strip and help health authorities to take serious measures for prevention and control, and educate peoples towards the biology of *Enterobius*.

It is recommended that STP should be used to confirm the clinical diagnosis of physicians in case of anal itching.

Key Words: Enterobiasis, prevalence, STP, pre-school, children, Gaza

Introduction

Intestinal parasitic infection in the Gaza strip is considered problematic, probably due to factors related to health conditions like, poor sanitation, overcrowding, bad hygienic habits, environmental contamination (Smith, 1993) and poor health education (Shubair et al., 2000). During the last two decades a number of studies have been reported concerning the prevalence of intestinal parasites among school children and pre-school children of the Gaza strip. Statistics show that the prevalence of intestinal parasites in Gaza strip ranges from 24% up to 53%. The most common intestinal parasites of Palestinian school children are *A. lumbricoides*, *Entamoeba sp*, *G. lamblia*, *Enterobius spp.* and *S. stercoralis* (Abed,1979; AL-Wahaidi,1997; Yassin et al., 1999; Al-Hindi, 2002). Most of the previous studies indicated that *G. lamblia* infection among school children in Gaza strip, ranges from 30%-60% as reported by many authors. In a cross sectional study, Al-Wahaidi (1997) reported that *G. lamblia* was the most frequent species (55%-64.3%) found among the pre-school Palestinian children living in Gaza. Before more than two decades Yassin *et al.*, (1999) in a study dealing with the prevalence of intestinal parasites among 489 school children (6-11 years old) in Gaza city reported that the overall prevalence of *G. lamblia* was (62.2%), followed by *A. lumbricoides* (20.1%) and then *Entamoeba sp.* (13.3%). Shubair *et al.*, (2) reported similar percentages and the same parasites among 6-11 years old school children including 556 subjects in Gaza. In a study carried out among school children in Deir El-balah town Gaza strip, Al-Hindi (2002) found that the overall percentage of positive cases with intestinal parasites was 36.3%. Al-Agha and Teodorescu (2000) reported a high prevalence of intestinal parasites (53%) among school children in Jabalia, Gaza Strip.

A house hold survey that included 1000 individuals from all ages was conducted in Biet-lahia, Palestine. Wet mount using saline and iodine and sedimentation techniques were used in detection of helminthes eggs and protozoan parasites. It was found that 72.9% of examined individuals were infected with different types of intestinal parasites (AL-zain B & AL-Hindi, 2005).

In a study of 432 stool samples collected from school children aged 6-11 years old, each stool sample was examined using wet mount

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and formal ether sedimentation technique. Of these 432 stool samples 125 (28.9%) were found to be parasite positive. The role of health education in decreasing prevalence of intestinal parasitic infection was statistically significant ($P= 0.001$) (Kanoua et al., 2006).

From laboratory results evidence for infection with the gastrointestinal parasites was found in 176 (33.7%) of the children among hospitalized children attending the Al-Nasser Paediatric Hospital while the results of questionnaire recorded 23%. The intestinal parasites were most prevalent in females (38.8%). The most highly prevalent parasite was found to be *E. histolytica/dispar* (26.4%) and the monthly high prevalence of intestinal parasites was in February (54.5%) (Al-Hindi, 2009).

The aim of the present study was to use the proper technique STP for the detection of *Enterobius vermicularis* whether eggs or adult with the following objectives:

1. To estimate the prevalence of *E. vermicularis* in Gaza Strip.
2. To associate between *E. vermicularis* prevalence and risk factors such as socioeconomic status and environmental health.

Subjects, Materials and Methods

Demography, Environmental health, socio-economic conditions of the study area

The Gaza Strip is divided into five governorates; North (286,246 person), Gaza (519,027 person), Mid- Zone (215,808 person), Khan-Younis (283,286 person) and Rafah (182, 449 person). The total surface area of Gaza Strip is 360 km², where about 1,644,293 Palestinian people live and work (PCBS, 2012). It is very crowded area and the population density estimated at 3,505 persons per Km² (UNEP, 2003).

The Unemployment rate for the 15-to-19-year age group reaches 72%, while unemployment affects 66% of those aged between 20 and 24 years (UNSCO, 2011). In Gaza Strip, the main source of groundwater comes from the coastal aquifer (shallow aquifer), which consists mainly of sandstone, sand and gravel (Ahmed, 2007). It is reported that 53% of the population in Gaza strip are connected to sewer networks, while cesspits and septic tanks receive the rest. Thus, there is a great need to put a high priority to set up an effective wastewater management system in Gaza strip (MOH, 2001).

The houses in Gaza strip have poor construction in some places like refugee camps where the houses very close to each other, no green areas. Also crowding is a common feature in the refugee camps and other parts of Gaza Strip.

This is a cross-sectional study targeted pre-school children during the period from October to December, 2009. The study included 149 pre-school children from refugee camps and cities who are residing in four Governorates in Gaza Strip; north Gaza, Gaza, mid zone (represented by Deir El-Balah) and Khanyounis in Gaza Strip.

Samples size was calculated using population of children aged from 1-5 years that was 45,000 children in Gaza strip, the confidence interval was assumed to be 8, and then the sample size was 149 to estimate the point prevalence (Sample size, 2011).

Sampling method

Sampling included three stages:

First stage: Twenty kindergartens (KG) were choosed in the four governorates.

Second stage: Simple random selection of one KG in each governorate.

Third stage: Simple random selection of the children was used through the selection of one class in the selected kindergarten in each governorate.

Data collection

1. Parasitological methods for *E. vermicularis*

Each child was visited in his home and the mothers were notified about the procedure of doing scotch tape preparation (STP) and were asked not to shower their children and not permit them to defecate in the morning before doing the examination. Each STP was adhering to labeled glass slides, inside special sacs which delivered in the next day to the kindergarten.

Collected specimens were examined microscopically for pinworm eggs by the first author. When one Enterobius egg or more were seen under microscope using X10 was considered positive.

2. Questionnaire

Information's such as age, sex, residence, sociodemographic characters, environmental health characters and child personal hygiene

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(checklist by observation).

Ethical Considerations

Ethical approval was obtained from Helsinki committee in Gaza Strip dated 9-9-2009. Oral approval from each family child was obtained and detailed description about the objectives of the study was given.

Statistical analysis

The collected data of work were introduced to the computer system and analyzed by using SPSS (Statistical Package for Social Studies) was used for statistical analysis version 15. Analysis of variable, frequency tables, cross tabulation, χ^2 - test was used, Spearman correlation for the significant variables and graphs were carried out.



Fig. 1. Map of Gaza Strip shows the five governorates (<http://www-tc.pbs.org>, 2008)

Results:

The present study included 149 pre-school children, 74 (49.7%) were males and 75 (50.3%) were females. The participant children are residing in 4 regions in Gaza Strip as follows: 74 (49.75) in north Gaza, 21 (14.1%) in Gaza city, 18 (12.1%) in the mid zone and 36 (24.2%) in Khanyounis. The general prevalence of *E. vermicularis* among preschool children under the age of five years was found to be 69 (46.3%).

From table 1. It was found that the percentage of infected males with *E. vermicularis* was 41 (55.4%) and for females was 28 (37.3%) with a significant difference (p=0.02). No variation was noticed in the prevalence of *E. vermicularis* regarding crowdingness. Similar prevalence of *E. vermicularis* was noticed among the children whether their mothers had a primary or higher education. Also it was found that there were no differences in the results whether the fathers were employee or un-employee and the mothers were working or not.

Table 1: Prevalence of *E. vermicularis* infection in relation to sociodemographic factors.

Variable	Prevalence of <i>E. vermicularis</i>				P-value
	Infected (n=69)		Not-infected (n = 80)		
	No	%	No	%	
Sex					0.020*
Male	41	55.4	33	44.6	
Female	28	37.3	47	62.7	
Crowding index					0.973
Less than 6 member	30	46.2	35	53.8	
More than 6 member	39	46.4	45	53.5	
Mother education					0.611
Primary	4	50.0	4	50	
Preparatory	14	42.4	19	57.6	
Secondary	32	45.1	39	54.9	
University	19	51.4	18	48.6	
Father education					0.646
Primary	7	53.8	6	46.2	

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Preparatory	15	36.6	26	63.4	
Secondary	26	51.0	25	49.0	
University	21	47.7	23	52.3	
Father occupation					0.856
Employed	26	47.3	29	52.7	
Unemployed	43	45.7	51	54.3	
Mother occupation					0.808
Employed	5	50.0	5	50.0	
Unemployed	64	46.0	75	54.0	

P≤0.05 is significant, NIS: new Israeli Shakle, χ^2 - test was used.

It was found that children who drink from kitchen filters have high rate of *E. vermicularis* than other children who drink from other sources (65%), followed by vendor water (53.7%) with a significant difference (p=0.003). Moreover children who are living in areas with open sewers was found to be less infected 30.4% than who resides in areas with closed sewers 49.2% (p=0.075). And there is no significant relationship between who has closed sacs or open containers for solid waste removal. Children belong to families rearing animals had higher rate of *E. vermicularis* 56.3% than who don't (p=0.093) (Table 2.).

Table 2: Prevalence of *E. vermicularis* infection versus environmental health.

Environmental factors	Prevalence of <i>E. vermicularis</i>				P-value
	Infected (n = 69)		Not-infected (n = 80)		
	No	%	No	%	
Source of drinking water					0.003*
Wells	3	25.0	9	75.0	
Municipality	9	23.7	29	76.3	
Kitchen filter	21	65.6	11	34.4	
Vendor filtered water	36	53.7	31	46.3	
Type of sewage system					0.075
Open	7	30.4	16	69.6	
Closed	62	49.2	64	50.8	

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Ways of solid waste removing					0.500
Closed sacs	62	47.3	69	52.7	
Open containers	7	38.9	11	61.1	0.093
Animal rearing					
Yes	27	56.3	21	43.8	
No	42	41.6	59	58.4	

P≤0.05 is significant, χ^2 - test was used.

From table 3. It was found that children who had accepted external body form (EBF) (General appearance) had low Enterobiasis 42.6% compared to who had not accepted EBF 63% with significant difference (p=0.044). Also, children who are cutting their nails had low enterobiasis 37.4% compared to those who are not 60.3% (p=0.005).

Table 3: Prevalence of *E. vermicularis* infection in relation to personal hygiene by observation

Child personal Hygiene	Prevalence of <i>E. vermicularis</i>				P-value
	Infected (n = 69)		Not-infected (n = 80)		
	No	%	No	%	
Child general appearance					0.044*
Accepted	52	42.6	70	57.4	
Not accepted	17	63.0	10	37.0	
Cutting nails					0.005*
Yes	34	37.4	57	62.6	
No	35	60.3	23	39.7	
Washing hands in the morning					0.001*
Yes	34	35.8	61	64.2	
No	35	64.8	19	35.2	
Availability of soap in toilet					0.368
Yes	68	46.9	77	53.1	
No	1	25.0	3	75.0	
Children hand washing after Defecation					0.474
Yes	59	46.8	67	53.2	
No	10	43.5	13	56.5	

P≤0.05 is significant, χ^2 - test was used.

Children who clean their hands in the morning had low enterobiasis 35.8% compared to others who do not 64.8% ($p=0.001$). Availability of soap in toilets had no effect for the prevalence of enterobiasis.

Enterobiasis was found to be low among children who washing their face in the morning 45.9% compared to who do not 66.7% but there was no significant difference ($p=0.444$).

From Table 4. Most reviewed literature and Ministry of Health records indicated that enterobiasis prevalence was estimated through stool analysis while the present study employed STP method.

Table 4: Prevalence of *E. vermicularis* infection from the literature cited in Gaza Strip and Ministry of Health Records.

Author/s and year	Country	Prevalence %	Method of diagnosis
Yassin et al., 1999	Gaza Strip, Palestine	1.0	Stool analysis
Shubair et al., 2000	Gaza Strip, Palestine	3.0	Stool analysis
Abu-Murad, 2004	Gaza Strip, Palestine	50.1	Questionnaire
El Kichaoi et al., 2004	Gaza Strip, Palestine	1.4	Stool analysis
Al-Hindi, 2009	Gaza Strip, Palestine	0.6	Stool analysis
Al-Hindi and Al-Zain, 2008	Gaza Strip, Palestine	3.2	Stool analysis
Ministry of Health (MOH), 2001	Gaza Strip, Palestine	0.5	Stool analysis
MOH, 2002	Gaza Strip, Palestine	0.4	Stool analysis
MOH, 2003	Gaza Strip, Palestine	0.3	Stool analysis
MOH, 2004	Gaza Strip, Palestine	0.1	Stool analysis
MOH, 2005	Gaza Strip, Palestine	0.1	Stool analysis
MOH, 2006	Gaza Strip, Palestine	0.1	Stool analysis
Kanoa et al., 2006	Gaza Strip, Palestine	0.5	Stool analysis
Al-Hindi et al, the present study	Gaza Strip, Palestine	46.3	Scotch tape Preparations (STP)

Discussion

Enterobiasis is one of the common intestinal round worms infecting wide range of people especially children. In the present study the percentage of infected children was 46.3% which is lower than that reported among 80 Turkish children who reached 71.3%

using the same diagnostic technique perianal tape test (Çulha and Duran, 2006). Also it was reported that the overall egg positive rate was found to be 7.9% among Korean preschool children from 20 kindergartens (Kang et al., 2006).

Most diagnostic techniques in health institutions in Gaza Strip are using wet mount with saline and iodine for the detection of *Enterobius vermicularis*. However, this kind of diagnosis does not give real estimates about the prevalence of *E. vermicularis* (under reporting) in Gaza Strip through scotch tape preparations (STP). Also, the Ministry of Health records showed that the prevalence of *E. vermicularis* was 0.59%, 0.46%, 0.34%, 0.17%, 0.18%, and 0.16% in the years 2000-2005 (MOH, 2002; MOH, 2003; MOH, 2004; MOH, 2005; MOH, 2006), where examination used wet mount by saline and iodine not STP.

In the present study one method for the diagnosis of *Enterobius vermicularis* (STP) was applied. Intensity of infection with *Enterobius* was not included in the present study (number of worm burden was not numerated for each child) because this need to collect stool sample after treatment and numerate males and females, which was out of the present study objectives.

A prevalence of *E. vermicularis* (7.5%) was reported in Nalout popularity, western Libya (Al Kilani et al., 2008). While among preschool children in Karmouz district, Alexandria was 46% (El Sahn et al., 2000) which consistent with our findings.

Enterobiasis are more common among school- and pre-school children and in crowded places where a prevalence of 45.38% was reported by Tukaew et al., (2002) and this was similar to our results where Gaza Strip is a crowded area.

In a study it was reported that prevalence of *E. vermicularis* infection and family socioeconomic status showed no significant differences among various groups and this was in accordance with our results (Nithikathkul et al., 2001).

The present study confirm the suggestion where children who are residing in homes with closed sewers was highly infected with *Enterobius* than children in homes with open sewers ($p=0.07$).

In the present study, children who drink filtered water was found highly infected with *Enterobius* than others who drink tap water

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($p=0.03$). It is worth to mention that filtered water in Gaza obtained by two ways; portable water sold by vendors where this pose contamination problem through delivery to homes where hosepipe was in contact with land. The second is the electrical filter installed in kitchens. These results are supported with (Wani et al., 2010) who reported that most frequently associated with infection included the water source and personal hygiene.

Availability of soap did not affect the prevalence of *E. vermicularis* where infection increased when there is no soap ($p=0.001$) and this suggest another source of infection.

Cutting nails was associated with *E. vermicularis* prevalence where the infection was lower in children who trimmed their nails ($p=0.005$) compared to who do not.

Most children studied came from low income level but their infection with Enterobius was lower than whom with high income level. This may be explained by that the source of infection available for both groups. Different results regarding income level was reported by Pethleart et al., (2010).

The general socioeconomic conditions and housing quality of the Gazans is very difficult especially in the presence of siege from more than seven years on Gaza Strip. In the same time the studied four regions large number of residents are refugee camps located in poor houses connected to each other, no green spaces between those houses.

In Al-Nussirat refugee camp, Abu-Murad (2004) reported that the mean of the crowding index, which was calculated as 2.7 individuals per room, was significantly higher than the optimal mean of one individual per room. This may explain the high prevalence of Enterobius in the present study. These results may shed the light on an infectious disease in Gaza Strip and help health authorities to take serious measures for prevention and control, and educate peoples towards the biology of Enterobius. Beside the health messages need to be given to households that should care for the danger of Enterobius, awareness towards infection and transmission for those diseases.

According to the Ministry of Health records and the literature reviewed by the authors, it is obvious that the estimated prevalence of *E. vermicularis* was recorded when stool specimens were examined by

wet mount not by scotch tape and it was very low prevalence. So, the present findings will give a true estimate for the prevalence of *E. vermicularis* in Gaza Strip.

Low prevalence *E. vermicularis* was recorded among school children in northern districts of West Bank, Palestine and from patients in Sana'a city, Yemen. (1.6%, 0.4%) respectively (Hussein, 2011; Alyousefi et al., 2001). Both studies used stool analysis for *E. vermicularis* detection.

Conclusion and recommendation

It is concluded that enterobiasis constituted a high prevalence among pre-school children in Gaza strip (46.3%).

It is recommended to use STP to confirm the clinical diagnosis of physicians in case of anal itching. Periodical examination and monitoring of kinder garden children should be taken.

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