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ORIGINAL ARTICLE

Prevalence And Associated Risk Factors of Intestinal Parasites Among Sanitation Workers and Work Conditions at Gaza Municipality

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Abstract

Sanitation workers (SWs) are a potential source of infection for many intestinal parasites and other enteropathogenic infections as well. The aim of the present study was to determine the prevalence of intestinal parasites carriers among SWs at Gaza Municipality and focusing on the associated risk factors through their work. This is a cross-sectional study, where stool samples were collected from 199 SWs aged between 18 to 65 years and were examined following standard parasitological methods including wet mount using saline and iodine and formal ether sedimentation technique. Demographic, environmental, behavioral and some risk factors were addressed through a questionnaire. Intestinal parasites were detected among 45/199 of the sanitation workers with a prevalence of (25.1%). Five species of protozoan or helminth infections were recorded, and the mixed infections were 2.5%. Where, most prevalent parasite among the SWs is *E. histolytica while A. lumbricoides* showed the lower rate of infection. It is concluded that most of the SWs are at high risk for intestinal parasites. The most risk factor was workers have their breakfast during the work. It is recommended that health education in general should be increased to raise awareness In additions improvement in work conditions and providing personal protection tools for workers and encourage adherence to use it and specify times and place for break to take their breakfast.

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1. Introduction

Intestinal parasites are considered as the most common communicable diseases worldwide, with special concern in developing countries. Globally, about 3.5 billion people are affected and 450 million complain as a result of these infections[1]. The prevalence of intestinal parasitic infections is considerably varied in the different regions of the world. It depends on so many factors such as geographic and socioeconomic factors, relatively humid areas, poverty, malnutrition, personal and community hygiene, high population density, unavailability of potable water and low health status, and poor sanitary facilities[2].

Sanitation workers who are not protected by adequate health and safety measures risk injury, infection, disease, mental health issues, and death. Specifically, the reported physical and medical conditions directly associated with sanitation work include headaches, dizziness, fever, fatigue, asthma, gastroenteritis, cholera, typhoid, hepatitis, polio, cryptosporidiosis, schistosomiasis, eye and skin burn and other skin irritation, musculoskeletal disorders (including back pain), puncture wounds and cuts, blunt force trauma, and fatality[3].

Humans become infected by accidental ingestion of eggs at their infective stage or through penetration of the skin by infected larvae in soil, depending on the nematode species[4].Water-borne, water-related, water-washed, and water-based diseases (e.g., intestinal parasitic infections, diarrheal diseases, skin, and eye infections) are associated with a lack of safe sanitation practices[5,6].

The situation of intestinal parasitic infection in Palestine is still a problem, probably due to defect in health status, poor sanitation, population crowdedness, bad hygienic habits, and poor health education mainly in Palestinian Refugee Camps[7,8].

Gaza Governorates are considered an endemic area for parasitic infection since population size, density, socio-economic and environmental factors contribute to the development and transmission of many intestinal parasites[9].

Gaza Strip residents have suffered from intestinal parasitic diseases for decades. Studies have commonly reported the existence of nematodes (*Ascaris lumbricoides, Enterobius vermicularis, Strongyloides stercoralis, and Trichuris trichiura), cestodes (Hymenolepis nana), and protozoa (Entamoeba histolytica/dispar, Giardia lamblia, and Cryptosporidium parvum*)[10,11]. According to our knowledge no studies have been carried out among sanitation workers at Gaza Municipality.

Therefore, the present study aimed to determine prevalence of intestinal parasites among sanitation workers (SWs) at Gaza Municipality and the associated risk factors and the work conditions.

2. Methods

Ethical considerations

An ethical approval was obtained from the sanitation Department, Gaza Municipality. SWs signed an informed consent form prior to the data collection exercise for anonymity and stool sample.

Data collection

The present study is a cross sectional study has been carried out amongst SWs at Gaza Municipality, where those workers are collecting garbage from inside Gaza city either using broom by hand, or pulling cart, or using garbage collection car. The stool samples were collected and processed in the Parasitology laboratory of Islamic University of Gaza. A total of 199 stool samples were collected from SWs at Gaza Municipality. A questionnaire including different themes like: socio-economic status, personal hygiene level, medical symptoms, work conditions, injuries during the work and protective tools during work as potential risk factors.

Sanitation department staff

A total of 26 of Sanitation Department staff were interviewed regarding the commitment of SWs towards using personal protection tools (PPTs).

Samples collection and examination

Each SW's at Gaza municipality was asked to bring a stool sample avoiding contamination with urine, water and other substances in sterile plastic container. Each stool sample was examined using standard parasitological techniques through wet mount and sedimentation methods (formal-ether methods)[12].

Health education session

SWs were invited to attend four health education sessions. The first session included information regarding the intestinal parasites and how to avoid, the other three sessions included information regarding occupational risks facing those workers like; injuries from broken items in the garbage sacs, smells, muscles injuries when

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carrying sacs or through the work on the garbage cars.

Data analysis

Data was entered to computer and analysed using Statistical Package for Social Sciences (SPSS v.22) software. The results presented through histograms, tables and pie charts. Chi square test was performed to detect significant differences among parasite type from various sources and the potential risk factors. Statistical significance was considered at $P \leq 0.05$.

3. Results

The study sample comprised 199 of SWs at Gaza Municipality, aged between 18-65 years (Table. 1). The present study indicated that 45 of the SWs were infected with intestinal parasites with an overall prevalence 25.1% and 2.5% (5/199) had double parasitic infection (two cases with *E. histolytica/dispar* and *A. lumbricoides*, one case *E. histolytica/dispar* and *G. lamblia* and two cases of *E. histolytica/dispar* and *E. coli*) as shown in (Fig.1). The detected intestinal parasites are shown in Fig.1. The highest parasitic infection was among 18-28 age group with a prevalence of 27.4%, but no significant difference was found (P = 0.70).

Table 1: The associated risk factors and intestinal parasitic infection among sanitation workers (n=199)

Risk factors	No. tested	No. Infected (%)	P-value
Age group, years			
18-28	43	12 (27.9)	0.80
29-39	48	10 (20.8)	
40-49	54	11 (20.4)	
>49	54	12 (22.2)	
Residence of each worker:			
Gaza west	74	14 (18.9)	0.13
Gaza mid	19	7 (36.8)	
Gaza north	80	15 (18.8)	
Gaza south	26	9 (34.6)	
Education of each worker:			
Primary	82	22	
Preparatory	55	(26.8)	
Secondary	46	7 (12.7)	
University	8	12 (26.1)	0.37
Un-educated	8	2 (25)	
		2 (25	
Sewage type:			
closed sewers	165	37 (22.4)	0.52
open sewers	34	8 (23.5)	
Marital status of each worker:			
married	181	41 (22.7)	0.61
unmarried	18	4 (22.2)	
Presence of cats in house			
Yes	66	16 (24.2)	0.41
No	133	29 (21.8)	
Smoking status			
Yes	77	12 (15.6)	0.04
No	122	33 (27.0)	

P < 0.05 is significant

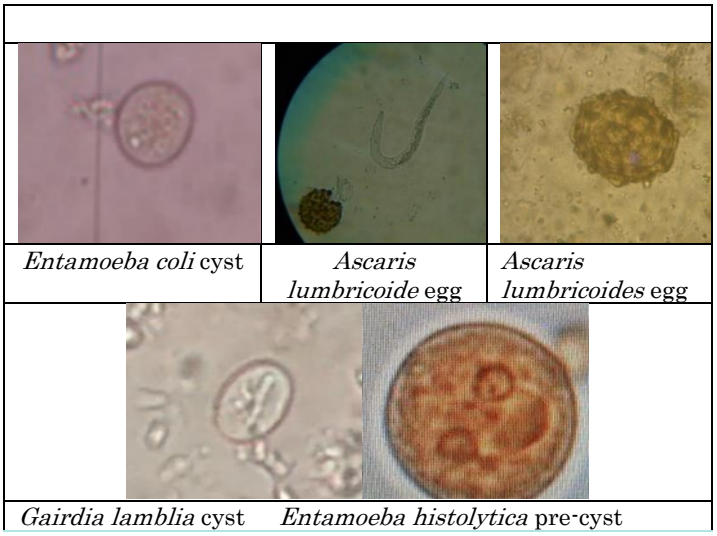

Figure1: The detected intestinal parasites among SWs

The results showed that SW who are smoking had low infection prevalence (15.6%) than who are not smoking (27%) with a significant difference equal (p=0.04).

In the present study two types of intestinal parasites were isolated: protozoa which constituted 94% and helminths constituted 6%. In addition *E. histolytica/dispar* was the most prevalent intestinal parasite 19.1% (Fig.2.).

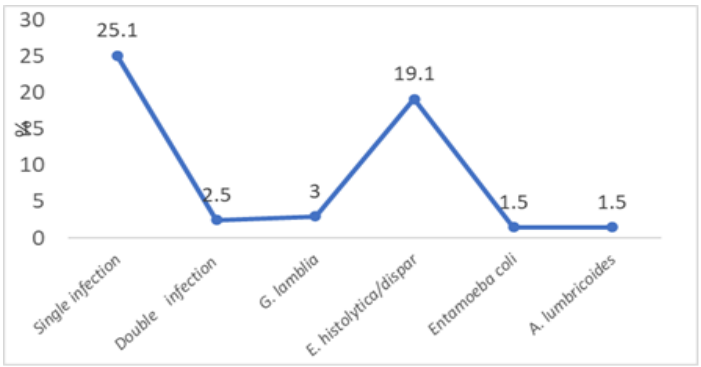

Figure 2: Single infection, double infection and different types of intestinal parasites in sanitation workers

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Analysis of the results using the chi square test showed statistically significant results with the following symptom; loss of weight (P=0.058). Other symptoms did not show statistically significant differences as shown in Table 2.
Table 3. shows the daily risks/accidents challenging the SWs during the work, where the SWs reported back pain with a prevalence of 44.2%.

Table 2: The reported medical systems among sanitation workers with relation to parasitic infection (n=199)

Type of Symptom (n=)	No. Infected (%)	P- value
Presence of symptoms		
(Yes)13 (No) 186	3 (23.1) 42 (22.6)	0.59
Worm discharge from each worker		
(Yes)18 (No) 181	4 (22.2) 41 (22.7)	0.61
Diarrhea		
(Yes)11 (No)188	Yes 3 (27.3) No 42 (22.3)	0.47
Colic		
(Yes) 8 (No) 191	Yes 3 (37.5) No 42 (22.0)	0.26
Loss of appetite		
(Yes) 10 (No) 189	Yes 3 (30) No 42 (22.2)	0.40
Bloody stool		
(Yes) 4 (No) 195	Yes 0 No 45 (23.1)	0.35
Loss of weight		
(Yes) 8 (No) 191	Yes 4 (50) No 41 (21.5)	0.058
Chest pain		
(Yes) 9 (No) 190	Yes 2 (22.2) No 43 (22.6)	0.66
Any breathing difficulties?		
(Yes) 8 (No) 191	Yes 1 (12.5) No 44 (23.0)	0.42

P < 0.05 is significant

Table 3: Work conditions and accidents of sanitation workers (n=199)

Variables	No	(%)
Working hours each day		
5-6 hours ≥ 7 hours	164 35	(82.4) (17.6)
Work accidents?	105	(52.8)
Type of accident:		
breaking hand or leg wound sprain foot or hand others	29 67 9 18	(14.6) (33.7) (4.5) (9.1)
Complaining from any back pain	88	(44.2)
Complaining from any neck pain	47	(23.6)

Table 4 shows the effect/no effect of using personal protection tools (PPTs) during the work by street sanitation workers.

Table 4: The intestinal parasitic infections and certain personal protection tools (PPTs) among sanitation workers (n=199)

Variable	No (%)	P- value
Gloves wearing		
(Yes)74 (No)125	15 (20.3) 30 (24.0)	0.33
Boot or sandal wearing		
Boat (123) Sandal (76)	27 (22) 18 (23.7)	0.45
Working on municipality car		
(Yes)15 (No)184	2 (13.3) 43 (23.4)	0.29
Garbage collection method		
garbage car (16) a donkey car (129) wheel barrow paid (28)	3 (18.8) 30 (23.3) 6 (21.4)	0.97
Health education attendance		
(Yes)10 (No)189	2 (20) 43 (47.5)	0.95
Washing hands before breakfast		
(Yes)160 (No) 39	34 (21.3) 11 (61.6)	0.36

Table 5 is indicating some of the risk factors facing sanitation workers as reported by the by staff of sanitation department and their association with the infection of sanitation workers with intestinal parasites. There was a significant relationship between the infection of sanitation workers and having their breakfast during the work (P = 0.008). In addition 33,3% of workers had break with a significant relationship (P = 0.02).
Table 5: The association between prevalence of intestinal parasitic infections and certain risk factors as reported by staff of sanitation department (n=26)

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Risk factor	No. %	p-value
Providing gloves to the workers	3 (11.5)	0.5
Monitoring of workers for gloves wearing	2 (7.7)	0.5
Availability of boats for workers during the work	4 (15.4)	0.6
Commitment of workers for gloves and boats wearing	3 (11.5)	0.9
Workers are dressing uniform	2 (7.7)	0.7
Workers have their breakfast during the work	3 (11.5)	0.008
Place of breakfast		
street specific place	3 (11.5) 3 (11.5)	0.5
Health education sessions	2 (7.7)	0.5
Risk exposure workers		
break wound others	1 (3.8) 3 (11.5) 2 (7.7)	0.02

P < 0.05 is significant

The health education session were launched to SWs for three weeks, in addition the hard work conditions facing SSWs as indicated in photo 1.

Photo 1: Health Education and work conditions for SWs

4.Didscussion

The overall prevalence of intestinal parasitic infections among the sanitation workers at Gaza Municipality was 25.1%. This was lower than the findings of a cross-sectional study was conducted on sewage workers from different sectors in Alexandria Governorate, Egypt (56.8%) were infected; among them (38.4%) had mixed infections.[13] But higher compared to the prevalence from Thailand (18.1%).[14] In Uganda, the highest point-prevalence of intestinal parasite infections was found among urban farmers (75.9%), whereas lowest point-prevalence was found in workers managing fecal sludge (35.8%).[15] The intestinal parasitic infections have different prevalence in some Arab countries or countries located in Middle East, for instance, reports on intestinal parasites have shown prevalence rates of 12.4% in Lebanon [16], 16.6-74.6% in Gaza strip (Palestine) [11,17], 28.5% in Jordan[18], 42.5% in Syria[19], 31.4-32.2% in Saudi Arabia[20-21], 33.9% in Qatar[22], and 27% in Egypt.[23] The leading/predominant intestinal parasite in the present study was *Entamoeba histolytica/dispar* (19.1%). This may be due to the potential contamination of the drinking water and the drainage of wastewater to the Gaza shore. Also, there is severe shortage of safe drinking water in Gaza Strip. Also, filtered drinking water is sold by street vendors with tanks hold on a car which has the potential of contamination may be from the filtration station, transferring the water to the houses or even the rubber. On the other hand, the overall prevalence of mixed infections was 2.5%. This was lower from the findings of previous studies conducted on East and West Gojjam, Ethiopia 44.1%.[24] Most sanitation workers at Gaza Municipality are illiterates or have primary school education where it was found that (48.69%) were infected with intestinal parasites. Where, this is one of the available occupations for those workers. There was no significant association between education status and intestinal parasitic infections. Similar finding was reported from a study conducted in Zarima town and Teda Health Centre, Northwest Ethiopia.[25] No significant difference was found in the distribution of parasitic infection among all age groups of sanitation workers, ranging from 18.6% to 27.4% prevalence, with a higher prevalence in the 18-28 years old group and lower in the 40-49 years old group. This shows that there is equal exposure to the infection and suggests an

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effect of environmental conditions on infection. In addition, no proper sealing of garbage sacs by the residents and the potential of contaminated diapers inside these sacs. As shown in our study the risk factors related to intestinal parasitic infections are including sewage type, place of breakfast during the work, presence of cats in the house and others. When comparing to the other studies which indicated that sewage workers were at a higher risk of developing intestinal parasitic infection especially amoebosis.[13]The health problems noted with the study group among Municipal Solid Waste Workers, Southern Thailand were musculoskeletal problems, skin problems, respiratory disease, nail problems, gastrointestinal problem, and eye problems o there was a strong correlation between waste disposal work and the reported health problems.[26] For the medical symptoms reported in the present study may constituting a bias due to these symptoms may be associated with the existence of other pathogens like bacteria and viruses which are not investigated in the present study. The using of personal protective tools (PPT) during the work like gloves and boat and even masks are very important to protect the workers. In India hazardous material is often found mixed with the municipal solid waste and includes discarded medicines, soiled bandages, dead animals, sharps, paints and batteries, including sharp items, for example razor blades, glass culets and metal pieces.[27] The spinal troubles (i.e., neck, upper back and low back pain"LBP") was reported in a population of sewage workers in Austria, and LBP was significantly positively associated with age.[28]In our study intestinal parasitic infection among SW smokers was 15.6% where the prevalence of smoking was 48.8% among workers of Bornova Municipality in Izmir, Turkey.[29] We found that smoking has a protective role in this study but it can't be recommended due the harmful effect of smoking in general. Khan reported different findings for the relation of intestinal parasites, addiction and smoking.[30] Risk of exposure of SWs to break and wounds and others was significantly reported.According to the head of sanitation department no adherence to PPT for SWs and this constituting health hazard during the work. In addition more than half of SWs had work injury and most SW are still using carat to collect garbage which affect the physical health of those workers.

5.Conclusions

This study showed occupational hazards for sanitation workers including intestinal parasites, hard work conditions, accidents and attitude of SWs towards neglecting the using of personal protection tools. The most risk factor was workers have their breakfast during the work.

RECOMMENDATIONS

It is the responsibility of the Ministry of Health to motivate all the control rules in Municipality, in order to minimize the distribution of intestinal parasitic agents. In additions improvement in work conditions and providing personal protections tools for workers and encourage adherence to use it and specify times and place for break to take their breakfast.

DECLARATIONS

Authors contributions

AlA contributed in literature review, designing, conceptualization, investigation, data curation, and critically reviewing the manuscript. FS reviewing, data curation, editing, and critically reviewing the manuscript. NM conceptualization, methodology, investigation. MA methodology, investigation,

Conflict o interest

The authors declare no conflict of interest

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