

## Original papers

# Intestinal parasitic infections among mentally handicapped individuals in Alexandria, Egypt

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**ABSTRACT.** This cross-sectional study was carried to determine the prevalence of intestinal parasitic infections among mentally handicapped individuals in Alexandria, Egypt, in the period from December 2012 till November 2013. The study was conducted on 200 institutionalized and non-institutionalized mentally handicapped individuals. Fresh stool samples were subjected to different stains including; trichrome for detecting intestinal protozoa, modified acid fast stain for intestinal coccidia and quick hot gram chromotrope stain for Microsporidia. Also they were processed by Kato-Katz and formol ethyl acetate techniques for intestinal helminths. Additionally, blood samples were collected for measuring hemoglobin levels. Out of 200 mentally handicapped individuals, 87 (43.5%) were infected. The infection rates were 44.6% and 42.6% for non-institutionalized and institutionalized people, respectively. Regarding gender, 46.7% and 38.5% were reported for the males and females respectively. The most common parasites detected were: *Cryptosporidium* sp. (23.5%), microsporidia (15%), *Giardia lamblia* (8.5%), *Dientamoeba fragilis* (8%), *Cyclospora cayanensis* (7.5%), *Blastocystis hominis* (6.5%), *Entamoeba histolytica* (5.5%) and *Entamoeba coli* (2.5%). Rates for *Isospora belli* and *Enterobius vermicularis* were estimated to be 1.5% for each, while lower rate was reported for *Iodamoeba buischlii* (1.0%). Prevalence of infections among mentally handicapped individuals are indications for several risk factors, including improper sanitary hygiene and illiteracy about personal hygiene. Therefore, frequent investigations, health care and medical intervention are needed.

**Key words:** mentally disabled persons, intestinal parasitic infections, Egypt

## Introduction

Intestinal parasitic infections are still a common problem in many tropical countries [1]. Annually, 16 million deaths occur due to parasitic diseases worldwide [2,3]. These infections are a major problem in rehabilitation centers for mentally handicapped individuals [4]. In addition to the endemicity, mental handicap is believed to be another risk factor for intestinal parasitic infections as most people with such disabilities cannot be trained for proper health behaviors [5]. Institutions, in which people live in crowded, closed community for long time, particularly in those with low sanitary level, are suitable environments for occurrence and transmission of parasites. Therefore, higher

prevalence rates of parasitic infections among their habitants are expected. Regular investigations for these groups are mandatory [6]. Family physicians are perhaps uniquely equipped to address issues of screening among them [7]. The present work aimed to study the prevalence of intestinal parasitic infections among mentally handicapped individuals in Alexandria, Egypt.

## Materials and Methods

This study was conducted in four institutions for mentally handicapped individuals representing four sectors in Alexandria Governorate from December 2012 till November 2013. The permanent residents of these institutions and regular daily visitors for

rehabilitation sessions (institutionalized people) as well as the temporary visitors (non-institutionalized) who gave informed consent were enrolled in this study. A total of 200 mentally retarded individuals were included in the present study (122 males and 78 females). Ninety two were non-institutionalized while 108 were institutionalized. The sample size was calculated by the following equation:

$$\text{Sample size} = \frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

For cross sectional study:  $Z_{1-\alpha/2}^2$  is the standard normal variation = 1.96 at  $p < 0.05$

$p$  = expected proportion in population based on previous studies

$d$  = absolute error or precision – has to be decided by the researcher

A predesigned questionnaire was used to collect the sociodemographic data and interviewer’s observations about individuals’ responses to simple orders. The intelligence quotient (IQ) scores were

Table 1. The rates of intestinal parasitic infections among institutionalized and non-institutionalized mentally handicapped individuals in Alexandria, Egypt (2013/2014)

Institutionalization	No. examined	Total infected n (%)	p-value\$
Non-institutionalized	92	41 (44.6)	0.779
Institutionalized	108	46 (42.6)	
• Permanent residents	36	15 (41.7)	0.891
• Regular visitors	72	31 (43.1)	

\$calculated for  $\chi^2$ -test

Table 2. Multiplicity of intestinal parasitic infections among institutionalized and non-institutionalized mentally handicapped individuals in Alexandria, Egypt (2013/2014)

Institutionalization	No. examined	Multiplicity of infection			p-value**
		Single n (%)	Double n (%)	Triple or more n (%)	
Non-institutionalized	41	24 (58.5)	12 (29.3)	5 (12.2)	0.046*
Institutionalized	46	16 (34.8)	16 (34.8)	14 (30.4)	
Total	87	40 (46.0)	28 (32.2)	19 (21.8)	

\*\*calculated for Monte Carlo test; \* $p < 0.05$  (significant)

collected from the institutions’ records. The IQ scores were calculated by Stanford binet intelligence test 4<sup>th</sup> edition for children and adults [8]. Stool and blood samples were collected from all participants. Samples were transported to the Parasitology Laboratory of the High Institute of Public Health, Alexandria University. Stool samples were stained with different stains, including trichrome [3,9] for intestinal protozoa, modified acid-fast stain[10] for intestinal coccidia and quick-hot gram chromotrope [11,12] for microsporidia. Also, stool samples were processed by Kato-Katz and formol ethyl acetate concentration (FEAC) techniques [10] for intestinal helminths. EDTA blood samples were collected for complete blood picture (Nissl, 2004) [13] and hemoglobin (Hb) levels were determined [14]. The results were recorded in data forms and analyzed by chi-square using the SPSS software version 16.0 (SPSS Inc., Chicago, IL).

Written consents were obtained from the Vocational rehabilitation manager, Social Affairs Directorate as well as from the parents. Ethically, infected individuals were treated at the end of the study.

### Results

Eighty seven out of 200 (43.5%) mentally handicapped individuals were infected with parasitic infections, 44.6% of non-institutionalized and 42.6% of institutionalized being infected but without a statistically significance difference. Among institutionalized individuals, the infection rates were 41.7% and 43.1% for permanent residents and regular visitors respectively, with no statistically significant differences (Table 1).

The non-institutionalized persons presented with higher percentages of single parasitic infection than

Table 3. The rates of intestinal parasitic infections among mentally handicapped individuals in relation to some sociodemographic factors in Alexandria, Egypt (2013/2014)

Variables	No. examined	Total infected n (%)	p-value*
<b>Gender</b>	Male	122	57 (46.7)
	Female	78	30 (38.5)
<b>Age</b>	<10	42	17 (40.5)
	10-	101	46 (45.5)
	20-	57	24 (42.1)
<b>Socioeconomic level<sup>†</sup></b>	Low	118	50 (42.4)
	Moderate	36	17 (47.2)
	High	7	1 (14.3)

\*calculated for  $\chi^2$ -test; MC – p-value for Monte Carlo test; <sup>†</sup>there are 39 missing data

the institutionalized (58.5% vs 34.8%). In contrast, the institutionalized showed a higher double infection (34.8%) and triple or more infections (30.4%) as compared to non-institutionalized (29.3% and 12.2% respectively). The difference was statistically significant ( $P < 0.05$ ), (Table 2).

Although males had higher rates of infection than females (46.7% vs 38.5%), yet no statistically significant difference was found. Also, the present work showed no statistically significant differences among different age groups, where the highest rate (45.5%) was detected among those aged “from ten to less than twenty” years old while the lowest rate

was found among “under ten years old” individuals (40.5%). The highest rate of infection was detected among individuals of moderate socioeconomic level (47.2%), followed by those who were of low level (42.4%), while the lowest infection rate was detected among those of high socioeconomic level (14.3%). However, no statistically significant difference between the infection rates was found regarding the socioeconomic level (Table 3).

Concerning the rates of infection in relation to IQ level, they were 28.6%, 34.9%, 48.3% and 60% among those who scored “less than 35”, from “35 to less than 55”, from “55 to less than 75” and from “75

Table 4. The rates of intestinal parasitic infections among mentally handicapped individuals in relation to the I.Q and level of response to instructions in Alexandria, Egypt (2013/2014)

Variables	No. examined	Total infected n (%)	MCP
<b>IQ<sup>†</sup></b>			
<35-	7	2 (28.6)	0.477
35-	43	15 (34.9)	
55-	29	14 (48.3)	
≥75	5	3 (60)	
<b>Response to instructions<sup>!!</sup></b>			
Good	13	5 (38.5)	0.524
Moderate	93	42 (45.2)	
Bad	26	12 (46.2)	

MCP – p-value for Monte Carlo test; <sup>†</sup> there are 116 missing data; <sup>!!</sup> there are 68 missing data

Table 5. The rates of intestinal parasitic infections in relation to Hb level and age of mentally handicapped individuals in Alexandria, Egypt (2013/2014)

Hb level (g/dl)	No. examined	<12 years Total infected n (%)	No. examined	≥ 12 years Total infected n (%)	FEp
<11.5	8	3 (37.5)	21	11 (52.4)	0.383
11.5-	12	4 (33.3)	18	9 (50.0)	0.301
≥12.5	14	6 (42.9)	68	31(45.6)	0.545

FEp – *p*-value for Fisher exact test

and more”, respectively. However, no statistically significant difference was found ( $p=0.477$ ). As regards the response to the instructions, the highest rate of parasitic infections was detected among those who had bad response (46.2%) followed by those who had moderate and good responses (45.2% and 38.5% respectively), with no statistically significant difference (Table 4).

The highest rate of parasitic infection (42.9%) was detected among children (less than 12 years) having a high Hb level ( $\geq 12.5$  g/dl), yet a high parasitic rate (37.5%) was also observed for anemic children (Hb<11.5g/dl). As regards older individuals, the highest rate of infection (52.4%) was among those with the lowest Hb level. The infection was found to decrease gradually with

improvement of Hb level, but no statistically significant difference was found (Table 5).

The commonest intestinal parasites detected in the present work were *Cryptosporidium* (23.5%) and microsporidia (15%). This was evident in all institutions except El-Seouf, where microsporidia were the most prevalent parasites. Lower rates were recorded for *G. lamblia* (8.5%), *D. fragilis* (8%), *C. cayetanensis* (7.5%), *B. hominis* (6.5%), *E. histolytica* (5.5%) and *E. coli* (2.5%). *E. vermicularis* and *Isospora belli* showed equal rates of 1.5%, while *I. butschlii* showed the lowest rate of 1.0%. Regarding the distribution of single parasitic infections between different institutions, *Cryptosporidium* and *Cyclospora* infection rates were significantly higher among residents of El-Mamora (Table 6).

Table 6. Distribution of different parasites among mentally handicapped individuals according to institutions in Alexandria, Egypt (2013/2014)

Parasites	Total infected N = 200	El-Mamora N = 36	El-Seouf N = 36	Moharram Bey N = 36	El-Awayed N = 92	<i>p</i>
	n (%)	n (%)	n (%)	n (%)	n (%)	
<i>E. histolytica</i>	11 (5.5)	3 (8.3)	0 (0.0)	1 (2.8)	7 (7.6)	MC <sub>p</sub> =0.308
<i>B. hominis</i>	13 (6.5)	5 (13.9)	1 (2.8)	1 (2.8)	6 (6.5)	MC <sub>p</sub> =0.263
<i>G. lamblia</i>	17 (8.5)	3 (8.3)	4 (11.1)	3 (8.3)	7 (7.6)	MC <sub>p</sub> =0.936
<i>D. fragilis</i>	16 (8)	4 (11.1)	2 (5.6)	4 (11.1)	6 (6.5)	MC <sub>p</sub> =0.689
<i>E. coli</i>	5 (2.5)	1 (2.8)	0 (0.0)	2 (5.6)	2 (2.2)	MC <sub>p</sub> =0.606
<i>I. butschlii</i>	2 (1.0)	1 (2.8)	0 (0.0)	0 (0.0)	1 (1.1)	MC <sub>p</sub> =0.785
<i>Cryptosporidium</i>	47 (23.5)	17 (47.2)	4 (11.1)	6 (17.0)	20 (21.7)	0.001*
<i>Cyclospora</i>	15 (7.5)	9 (25.0)	1 (2.8)	1 (2.8)	4 (4.3)	MC <sub>p</sub> =0.002*
<i>Isospora</i>	3 (1.5)	2 (5.6)	0 (0.0)	0 (0.0)	1 (1.1)	MC <sub>p</sub> =0.286
<i>Microsporidia</i>	30 (15)	9 (25.0)	7 (19.4)	4 (11.1)	10 (10.9)	0.169
<i>E.vermicularis</i>	3 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	3 (3.3)	MC <sub>p</sub> =0.655

MC – *p*-value for Monte Carlo test; \* statistically significant at  $p \leq 0.05$

## Discussion

The present study detected that overall parasitic infection rate was 43.5% among the mentally handicapped individuals in Alexandria. Similarly, Siddiqui et al. [15] reported that 47.54% of the mentally handicapped from Karachi-Pakistan were suffering from pathogenic parasitic infections. Recently, Shokri et al. [16] reported an infection rate of 48.5% among mentally retarded residents of institutions in southern Iran. However, a lower rate of infection (26.2%) was reported in northern Iran among mentally handicapped children [5]. In contrast to our finding, a much higher infection rate (76.67%) was detected among mentally retarded patients in Egypt by Mohamed et al. [17].

In the present work, the non-institutionalized individuals showed higher rates of total parasitic infection and mono-infection than the institutionalized meanwhile the multiple parasitic infection rates were higher among the institutionalized individuals, this may be attributed to the closed community in which they live. In contrast to our results, Sirivichayakul et al. [18] found that the prevalence of parasitic infections was higher in institutionalized (57.6%) than non-institutionalized people (7.5%) and reported that 33.5% of the institutionalized handicapped had a single infection while 16.2%, 5.7%, 1.8% and 0.3% of them were concomitantly infected by 2, 3, 4 and 5 species of parasites, respectively.

The higher infection rate among males compared to females in the present study (46.7% vs 38.5), is in agreement with that reported in Korea by Lee et al. [19] where the rates of infection were 38.5% for males and 29.4% for females. However, equal rates of infection were reported from Iran (2007–2008) (being 20.5% and 20.3%, respectively) [20].

The present work showed no significant differences between infection rates among different age groups, where the highest rate was recorded among teenagers while the lowest rate was found among younger individuals. Similarly, Lee et al. [19] revealed the highest rate of infection (23.7%) among teenagers aged “10–19 years old” with no infection among children under 10 years old and elders aged 40 years old or more. In Iran (2007–2008), it was revealed that the highest prevalence of intestinal parasitic infection (40%) was among children 5 years or less while the lowest prevalence (16.8%) was detected among those aged 18 years old or more [20].

The present work revealed that the highest rate of infection was detected among individuals with the highest IQ scores, this may be due to their abilities for doing different activities that expose them more to infection. In the study done in Irmia, Iran, the highest prevalence (40%) was reported among those with high IQ scores of “76–90” followed by those with the scores of “less than 25” (23.8%), while lower rates were recorded for those with other IQ scores (“25–50” and “51–75”) [20].

The present study revealed that protozoan parasites were the most frequent intestinal parasites (42%) while helminthic parasites were recorded in 1.5% of individuals examined, with *E. vermicularis* being the only helminth found. Similar results were recorded among children and adults of Urmia, Iran, where protozoal prevalence was 17% while *E. vermicularis* eggs were detected in 3.1% of cases [20]. Similar results were also observed in a study conducted in Thailand, where intestinal protozoal parasites were the most frequent (36.5%) while *Taenia* species was the only helminthic infection detected (1.9%) [21]. On the other hand, studies from Thailand, Korea and Iran revealed high infection rates with protozoal and helminthic species among the handicapped [18,19,22]. In contrast, the study done by Mohamed et al. [17] in Egypt, revealed only helminthic infections. In addition, the study carried out among children living in some institutions in Philippines, helminthic infection was the most predominant [23].

The most common intestinal protozoal parasite detected in the present work was *Cryptosporidium* followed by microsporidia meanwhile the lowest rate was recorded for *I. butschlii*. Sirivichayakul et al. [18] reported that the common parasites found in institutionalized people in Thailand were *E. coli* (23.1%); followed by *G. intestinalis* (8.0%), *E. histolytica/dispar* (7.1%), *Endolimax nana* (6%), *B. hominis* (0.8%). However, *Cryptosporidium*, *Cyclospora* and microsporidia were not detected. The highest infection rate of intestinal protozoa (9.7%) detected by Tappeh et al. [20] was for *E. coli*, followed by *G. lamblia* (6.2%), *I. butschlii* (5.7%), *B. hominis* (4%) and *E. histolytica/dispar* (0.4%). Also, Lee et al. [19] recorded percentages of 25% for *E. coli*, 21.4% for *E. nana*, 1.8% for both *E. histolytica* and *I. butschlii* and only 0.9% for *G. lamblia*.

## Conclusions

The high rates of intestinal parasitic infections among mentally handicapped individuals in Alexandria indicate their high risk of exposure to infection. Possible risk factors include improper sanitary hygiene and illiteracy about personal hygiene. Therefore, frequent investigation, health and medical care must be emphasized.

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