

Epidemiological study of heterophyiasis among humans in an area of Egypt

L.M. Abou-Basha,¹ M. Abdel-Fattah,² P. Orecchia,³ D. Di Cave³ and A. Zaki²

دراسة وبائية حول الإصابة بديدان الخيفانة (الهتروفيس) بين البشر في منطقة مصرية ليلي محمود أبو باشا ومعتز عبد الفتاح وبارولا أوريكيا ودافيد دي كافي وعادل زكي

خلاصة: كان هدف هذه الدراسة تعيين معدل انتشار العدوى بديدان الخيفانة (الهتروفيس)، ومدى كثافتها بين سكان منطقة المعدية في مصر. فأجري مسح مقطعي بفحص عينات برازية أخذت من 430 أسرة مختارة عشوائياً وتضم 2219 شخصاً. وتبين أن معدل الانتشار الإجمالي للعدوى بالطفيليات يبلغ 84.7%. وكان داء الصقر (الأسكارس) هو الأكثر انتشاراً (67.6%) ومن بعده داء المسلكات (التركيورس) (49.7%) ثم داء الخيفانة (الهتروفيس) (33.8%). وكان انتشار العدوى بديدان الخيفانة وكثافتها أعظم ما يكون في النطاق العمري 15-45 سنة. وكانت العدوى أكثر انتشاراً في النساء منها بين الرجال. ووُجدت أعلى كثافات العدوى بين الصيادين. وتبين أن حالات الإصابة بديدان الخيفانة (الهتروفيس) تتكثف في داخل العائلات.

ABSTRACT We aimed to determine the prevalence and intensity of infection of heterophyiasis among inhabitants of El-Meaddeya, Egypt. A cross-sectional stool examination survey was performed on 430 randomly chosen households, comprising 2219 individuals. The overall prevalence of parasitic infection was 84.7%. Ascariasis was the most common (67.6%), followed by trichuriasis (49.7%) and heterophyiasis (33.8%). The prevalence and intensity of infection of heterophyiasis were most common in people 15-45 years, and greater in females than males. The highest intensity of infection was detected among fishermen. Intrafamilial aggregation of cases of heterophyiasis was identified.

Etude épidémiologique de l'hétérophyase chez l'homme dans une région d'Egypte

RESUME Notre objectif était de déterminer la prévalence et l'intensité de l'hétérophyase chez des habitants d'El-Meaddeya (Egypte). Un examen transversal des selles a été réalisé dans 430 ménages choisis au hasard, comprenant 2219 individus. La prévalence globale de l'infection parasitaire était de 84,7%. L'ascariase était la plus courante (67,6%), suivie par la trichocéphalose (49,7%) et l'hétérophyase (33,8%). La prévalence et l'intensité de l'hétérophyase étaient plus courantes chez les personnes âgées de 15 à 45 ans et plus fortes chez les femmes que chez les hommes. La plus forte intensité de l'infection a été détectée chez les pêcheurs. L'agrégation intrafamiliale des cas d'hétérophyase a été identifiée.

¹Department of Parasitology; ²Department of Medical Statistics, Medical Research Institute, University of Alexandria, Alexandria, Egypt.

³Dipartimento di Sanità Pubblica e Biologia Cellulare, Università Tor Vergata, Rome, Italy.

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Introduction

Heterophyiasis is due to infection by very minute flukes called heterophoids. The adults live in the upper part of the small intestine embedded in mucus and mucosal folds. Heavy infection can cause abdominal pain and diarrhoea [1]. Heterophyiasis has been endemic in humans in the Nile Delta for decades [2].

Infection is acquired by eating raw fish, a common food in areas of heavy endemicity [3]. In endemic areas, people who live near lake shores or river banks usually have a higher rate and intensity of infection than those living a distance from such areas. It is possible that inhabitants of these areas eat more low-salted or improperly cooked fish, and that their fish are obtained from polluted water. It is common practice for people to defecate on the lake shores and river banks or from their boats while fishing, thus, perpetuating the cycle of infection [2,4].

Lake Edku is the smallest lake situated north of the Nile Delta. It is directly connected to the Mediterranean Sea at the western extremity through a narrow channel called Boughaz El-Meaddeya. The lake-sea connection is located in the inner part of a partially sheltered bay known as Abu Qir. Lake Edku lies west of the Rosetta branch of the River Nile, and extends from east to west for a distance of about 19 km, with an average depth of about 1 m.

Results of the European Community project carried out by the Department of Parasitology of the University of Alexandria revealed that *Melania tuberculata* snails and the grey mullet (*Mugils*) fish species *Liza ramada* and *L. aurata* found in El-Meaddeya village harbour larval stages (cercaria and metacercaria) of *Heterophyes* [5]. Our study was undertaken to determine the prevalence of human heterophyiasis

in El-Meaddeya village, which is suspected of being an endemic area, and to study the influence of some demographic characteristics on the intensity of the infection.

Subjects and methods

A map was prepared showing all of the houses (1292) in El-Meaddeya village in an area of 4 km in length. A frame for all houses was constructed and a systematic random sampling technique with a sampling proportion of 1:3 was applied. Occupants of 430 houses were asked to participate in the study. A short questionnaire was used to collect demographic data including individual's name, age, sex and occupation. They were also questioned about their habit of eating fish, including the type, size and method of cooking or processing.

Stool samples were collected from 2219 individuals and examined in the laboratory. Three different methods of stool examination were considered: simple sedimentation, formal ether and the Kato technique. The Kato technique was determined to be the most sensitive method, and the stools were examined only by this technique. It was used to determine the intensity of infection in the study population [6].

Statistical methods

Data were analysed using SPSS. The geometric mean egg count with a 95% confidence interval (CI) was calculated and presented in different subgroups. Significance of the differences between mean log egg counts was assessed using analysis of variation (ANOVA). In order to study the intrafamilial aggregation of cases, only families with more than three people examined were included ($n = 246$ families). The overall prevalence rate of *Heterophyes* infection in the study population was estimated

ed with a 95% CI. Frequency of *Heterophyes* infection in each family was calculated and families were divided into three different groups: group 1 included families with an infection rate within the 95% CI of the average estimated prevalence in the total study population; groups 2 and 3 included families with frequency of infection below and above the 95% CI respectively.

Results

The study included 2219 individuals, of whom 1027 were males (46.3%) and 1192 (53.7%) were females. Of the studied individuals, 13.7% were < 5 years of age while 12.7% were > 45 years. Housewives and fishermen constituted 28.0% and 16.5% of the study population respectively. The prevalence of parasitic infections in El-Meaddya village was found to be relatively high, affecting 84.7% of the population. *Ascaris lumbricoides* and *Trichuris trichiura* were the most frequent (67.6% and 49.7% respectively), followed by *H. heterophyes* (33.8%) as shown in Table 1. Regarding the patterns of eating fish, the participants ate all types and sizes of fish either grilled or salted for 1–2 days.

The highest prevalence of heterophyiasis was found in the age group 15–45 years (37.3%). Even in young children < 5 years, heterophyiasis was unexpectedly high (28.0%). It was more prevalent in females than in males (36.7% versus 30.6%), and in those without work (46.9%), housewives (35.9%) and those working as fishermen (35.8%) as shown in Table 2.

The intensity of heterophyiasis was highest in the age group 15–45 years (mean egg count 87.32, CI: 77.64–97.93). Intensity of infection was slightly higher in females (mean egg count 78.80, CI: 71.35–87.02) as compared to males (mean

Table 1 Sociodemographic characteristics of the study population ($n = 2219$) and their parasitic infection

Characteristic	No.	%
Age (years) ($n = 2212$)^a		
≤ 5	304	13.7
5–14	660	29.8
15–45	968	43.8
> 45	280	12.7
Sex		
Male	1027	46.3
Female	1192	53.7
Occupation ($n = 2215$)^b		
Unemployed ^c	145	6.5
Housewife	621	28.0
Student	616	27.8
Fisherman	366	16.5
Child (preschool)	147	6.6
Others	320	14.4
Parasitic infection^d		
Free	340	15.3
<i>Ascaris lumbricoides</i>	1501	67.6
<i>Trichuris trichiura</i>	1102	49.7
<i>Heterophyes</i>	751	33.8
<i>Hymenolepis nana</i>	19	0.9
<i>Fasciola hepatica</i>	18	0.8
<i>Schistosoma mansoni</i>	33	1.5

^aSeven cases with missed age.

^bFour cases with missed occupation.

^cBoth sexes.

^dThe sum does not add up to the total number examined because one individual can harbour more than one parasitic infection.

egg count 74.32, CI: 66.09–83.57). Fishermen had the highest intensity of heterophyiasis with a mean egg count of 95.46, CI: 78.32–116.33 as shown by Table 3.

Figure 1 shows that in 27.0% of families, all family members were free of heterophyiasis and in 48.0% of families, two or more individuals in the same family were infected. Only in 25.0% of the studied families was only one person infected ($\chi^2_{13} = 243.5$, $P < 0.0001$).

Table 2 Heterophoid infection by sociodemographic characteristics of the study population

Characteristic	Heterophoid infection						χ^2 (P-value)
	Total infected		Single		Mixed		
	No.	%	No.	%	No.	%	
Age (years)^a							
< 5 (n = 304)	85	28.0	18	5.9	67	22.0	19.7 (0.003)
5-14 (n = 660)	222	33.6	29	4.4	193	29.2	
15-45 (n = 968)	361	37.3	68	7.0	293	30.3	
> 45 (n = 280)	76	27.1	14	5.0	62	22.1	
Sex							
Male (n = 1027)	314	30.6	59	5.7	255	24.8	10.1 (0.006)
Female (n = 1192)	437	36.7	70	5.9	367	30.8	
Occupation^b							
Unemployed (n = 145) ^c	68	46.9	10	6.9	58	40.0	29.5 (0.001)
Housewife (n = 621)	223	35.9	32	5.2	191	30.8	
Student (n = 616)	192	31.2	28	4.5	164	26.6	
Fisherman (n = 366)	131	35.8	28	7.7	103	28.1	
Child (preschool) (n = 147)	38	25.9	11	7.5	27	18.4	
Others (n = 320)	95	29.7	20	6.3	75	23.4	

^aSeven cases with missed age.^bFour cases with missed occupation.^cBoth sexes.Table 3 Intensity of heterophoid infection according to the sociodemographic characteristics of studied cases^a

Characteristic	No.	Geometric mean of egg count	95% confidence intervals	Statistical data
Age (years)^b				
< 5	85	59.58	49.50-71.70	$F_{(3,740)} = 4.14$ $P = 0.0063$
5-14 years	222	72.29	62.82-83.21	
15-45 years	361	87.32	77.64-97.93	
> 45 years	76	66.01	53.78-81.00	
Sex				
Male	314	74.32	66.09-83.57	$t_{(749)} = 0.75$ $P = 0.455$
Female	437	78.80	71.35-87.02	
Occupation^c				
Unemployed ^d	67	89.13	69.28-116.6	$F_{(5,741)} = 2.94$ $P = 0.0123$
Housewife	223	81.36	70.60-93.24	
Student	192	65.61	56.98-75.58	
Fishermen	131	95.46	78.32-116.33	
Child (preschool)	38	66.74	45.04-98.90	
Others	96	65.99	53.98-80.22	

^aThere were 751 valid cases for intensity of infection.^bSeven cases with missed age.^cFour cases with missed occupation.^dBoth sexes.

The overall prevalence rate of heterophyiasis in our study population was 33.8% and the calculated CI was 27.89–39.71. Figure 2 shows that in 11.0% of the studied

families, the intrafamilial prevalence rate was within the 95% CI of the overall prevalence in the study population, while in 89.0% of the families the prevalence was below or above the 95% CI.

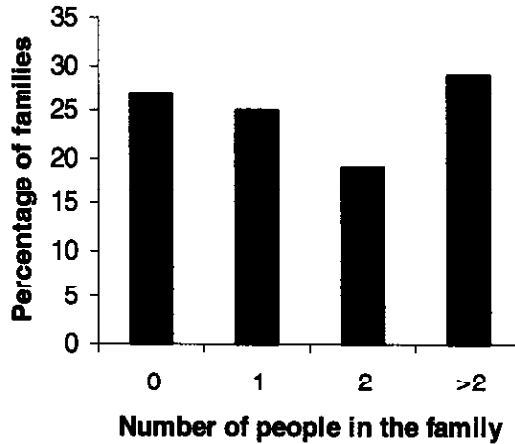


Figure 1 Percentage distribution of the families according to the number of infected persons within the family.

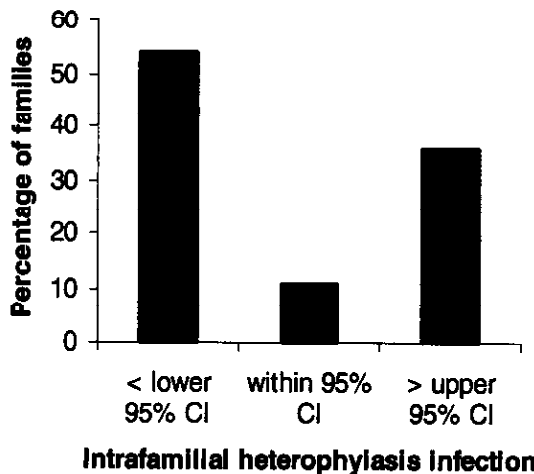


Figure 2 Distribution of the families according to the relation to the 95% confidence intervals (CI) of the overall prevalence of heterophyiasis.

Discussion

In general, parasitic infections in El-Meaddeya village were found to be very high, affecting 84.7% of the population. A study on the possible association with socioeconomic parameters and available sanitary facilities, housing conditions and food habits in El-Meaddeya village is needed to identify the possible causes of this high rate of parasitic infection.

In our study, the most impressive finding was the strikingly high prevalence of heterophyiasis, as more than one-third (33.8%) of the inhabitants were found to be infected. This figure is higher than that reported by El-Morshidy et al. [7] who reported in Baltim city, Kafr ash Shaykh governorate, a prevalence rate of 13.5%, and that of Rifaat et al. [8] who reported a prevalence rate of 5.1% in El-Matarria, Daqahliyah governorate and that of Yousef et al. who reported a prevalence rate of 5.0% in the outpatient department of a local hospital in Lake Edku [9].

Many fish have been described as intermediate hosts for *Heterophyes*, such as *M. cephalus*, *M. auratus*, *Tilapia nilotica* and *T. zilli* [3,10]. All of these types of fish were found in El-Meaddeya and the villagers ate all types and sizes of these fish either grilled or salted for 1–2 days [5]. This could explain the high prevalence rate of heterophyiasis.

Because both heterophyiasis and other parasitic infections were so common in the study village, an individual suffering from combined infection was the rule rather than the exception.

Despite the fact that the highest prevalence of heterophyiasis was found in the age group 15–45 years (37.3%), the prevalence, even in young children (< 5 years), was unexpectedly high (27.9%). These findings should stimulate planning activities

to raise public awareness about the mode of transmission of heterophyiasis and the importance of food hygiene. Also, the possible health impact of heterophyiasis on these children requires special attention. Subjective abdominal complaints, malabsorption, anorexia, vomiting and/or diarrhoea are among the possible signs to search for.

Heterophyiasis was more common in females than in males (36.7% versus 30.5%). El-Morshidy et al. recorded that the prevalence of heterophyiasis in Kafr ash Shaykh governorate was 13.5% and it was higher in females 20–34 years (17.3%) than males (13.5%) [7]. This is probably due to exposure to infection by females through handling, preparing and tasting of fish during cooking and processing, as it contains living larvae. This is also in agreement with the study of Nagaty and Khalil who reported prevalence rates of 14.5% and 22.3% among males and females respectively [11].

The intensity of heterophyiasis was highest in people 15–45 years (mean egg count 87.32, CI: 77.64–97.93). Intensity of infection was slightly higher in females than males and was highest in fishermen. The differences in the probability of becoming infected and the intensity of infection, whether by age, sex or occupation, were mostly attributed to variation in food habits.

Our study identified high intrafamilial aggregation of heterophyiasis as proven by the percentage of families (84.7%) in which the intrafamilial prevalence rate was below or above the 95% CI. This indicates that cases of heterophyiasis were not randomly distributed throughout the study population, but were aggregated in families. This is in accordance with the work of El-Morshidy et al., who reported clustering of cases of heterophyiasis in the same family due to sharing of food [7].

As heterophyiasis in El-Meaddeya is so prevalent, training of laboratory technicians in local health units to improve their diagnostic skills is warranted. It can be concluded that transmission of heterophyiasis in Egypt is continuous, especially in the vicinity of lakes with brackish water. Furthermore, we cannot ignore the role of fish caught from El-Meaddeya as a source of heterophyiasis since a large proportion of the population consumes fish.

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References

- Schmidt GD, Robert LS. *Foundations of parasitology*, 4th ed. St Louis, Times Mirror/Mosby, 1989.
- El-Makaddem A. *The prevalence of heterophoids in man, animals and various fish hosts in Edku area* [Thesis]. Alexandria, Egypt, University of Alexandria, 1982.
- Taraschewski H. Investigations on the prevalence of *Heterophyes* species in twelve populations of the first intermediate host in Egypt and Sudan. *Journal of tropical medicine and hygiene*, 1985, 88(4):265-71.
- El-Sahly AM et al. Intestinal helminthic and protozoal infections and urinary schistosomiasis in Egyptian children. *Journal of the Egyptian Society of Parasitology*, 1990, 20(1):9-21.
- Abou Basha LM. *Use of parasite species composition indices of fish to measure the edge of environmental deterioration due to pollutants and other man-made adverse effects*. Final report of Avicenne Initiative Project (Contract AVICT 92-0001) sponsored by the European Commission, 1999.
- Martin LK, Beaver PC. Evaluation of Kato thick-smear technique for quantitative diagnosis of helminth infections. *American journal of tropical medicine and hygiene*, 1968, 17(3):382-91.
- El-Morshidy HN et al. A study of heterophoid infection in Kafr ash Shaykh Governorate. *Menoufia medical journal*, 1994, 6(2):289-300.
- Rifaat MA et al. Studies on the incidence of *Heterophyes heterophyes* in Daqahliyah Governorate. *Journal of the Egyptian Society of Parasitology*, 1980, 10:369-73.
- Yousef MM et al. Heterophoid parasites of man from Edku, Mariyut and Manzala lakes areas in Egypt. *Journal of the Egyptian Society of Parasitology*, 1987, 17:475-9.
- Khalil M. The history of human trematode parasite *Heterophyes* in Egypt. *Lancet*, 1933, 2:225-37.
- Nagaty HF, Khalil HM. Incidence of helminth infection among the outpatients in the clinic of Mattaria collective unit, Daqahliyah Governorate, Egypt. *Journal of the Egyptian Medical Association*, 1964, 47:341-6.