Original article

Prevalence of heterophyid infection among Japanese residents of Egypt (2005-2008) and its association with length of stay

Eiichi Okuzawa^{1*}, Atsuo Hamada², Shinji Fukushima², Hideto Kino³ and Yutaka Sakurai¹

Received 31 March, 2010 Accepted 26 November, 2010 Published online 21 December, 2010

Abstract: A total of 300 stool samples collected from 213 Japanese residents of Egypt were examined microscopically. Among these samples, 39 were judged positive for heterophyid eggs. Sixty seven residents were examined repeatedly. The prevalence of heterophyid eggs revealed by the first examination samples was 8.5% (18/213) whereas that revealed by the second follow-up was 24% (16/67). The interval between the first and second examination was one year in 58 cases and 2 years in 9 cases.

The association of infection with the length of stay in Egypt was evident. Positivity among new residents (period of stay in Egypt < 1 year) was as low as 3% (2/60). Positive conversion from new residents was observed in 28% (7/25), indicating a positive association between heterophyid infection and the length of stay in Egypt among Japanese residents of that country.

Key words: Heterophyid infection; Japanese residents; Egypt.

INTRODUCTION

Heterophyid trematodes (Family Heterophyidae) are a common parasite among Japanese people living abroad [1].

Heterophyes heterophyes is distributed in the Nile Delta, while *Metagonimus yokogawai* is common in the Far East. *H. heterophyes* (v. Siebold 1852) was first found in the small intestine of an Egyptian child [2]. The proven snail hosts are *Perinella conica* in the Nile Delta [3]. The second intermediate hosts include *Mugil cephalus*, other *Mugil* spp. and *Tilapia* spp. [4]. A high intensity of human infection was detected among fishermen in an area of Egypt [5].

The prevalence of heterophyiasis among Japanese residents was 1% in 1996, 3% in 1997, 0% in 1998 and 9% in 1999 but increased sharply to 29% in 2000 [6]. Japanese residents of Egypt were infected by heterophyid parasites without consuming raw fish [7]. Sashimi and sushi are not likely to be the major source of infection. This paper reports the subsequent change in the prevalence of heterophyid infection and its association with the length of stay in Egypt.

SUBJECTS AND METHODS

The Labor Welfare Corporation, a Japanese governmental agency supervised by the Ministry of Labor and Health, conducted a visiting consultation for Japanese workers and their families in developing countries. This visiting consultation included a medical consultation, questionnaire and stool sampling. The consultation was held four times in Cairo, Egypt; 14-19 June 2005, 14-19 June 2006, 11-14 July 2007 and 2-6 July 2008. A total of 300 stool samples were collected from 213 residents at the time of consultation. These samples were fixed with 10% formalin in Cairo and brought to Japan. The fecal samples were processed by the formol-ether concentration technique, and the formol-ether sediments were examined microscopically for parasites [8]. Reports were sent to examinees with positive results advising them to consult a doctor. Questionnaires regarding the length of stay in Egypt were answered by the residents at the time of sampling.

A text database consisting of 300 records related to stool samples was prepared for analysis. Each record contained fields for personal identification, stool data and answers to the questionnaire. The statistical analyses were

¹ Department of Preventive Medicine and Public Health, National Defense Medical College

² Japan Overseas Health Administration Center, Labor Welfare Corporation

³ Institute for Experimental Animals, Hamamatsu University School of Medicine

*Corresponding author:

Tel: +81 4 2995 1563

Fax: +81 4 2996 5195

E-mail: okuzawa@ndmc.ac.jp

new residents*: length of stay in Egypt < 1 year

Figure 1: Flow chart for selecting records for analysis

done by GawK-3.1.5 on Red Hat Enterprise Linux 5. A flow chart for the selection of study subjects is presented in Figure 1. Written informed consent regarding the purpose of this study was collected from the participants.

RESULTS

Intestinal parasites among Japanese residents

Heterophyid eggs were detected in 39 of the 300 samples, as well as *Giardia intestinalis* in 3 samples and *Entamoeba coli* in one sample.

Prevalence of heterophyid parasites

Heterophyid eggs were detected in 11% of subjects in 2005, 11% in 2006, 15% in 2007 and 14% in 2008 (Table 1). The prevalence of heterophyid eggs revealed by the first examination was 8.5% (18/213) whereas that revealed by the second examination was 24% (16/67). There was a statistically significant ($p < 0.001$, χ^2 -test) difference between the two prevalence rates. The interval between the first and second examinations was one year in 58 cases and 2 years in 9 cases.

Association of heterophyid infection with the length of stay

The results of the first examination were selected to provide baseline data on the prevalence of heterophyid in-

Table 1: Prevalence of heterophyid infection among Japanese residents in Egypt (2005-2008)

Year	Number examined		
	Positive (%)	Negative (%)	Total
2005	9 (11)	70 (89)	79
2006	8 (11)	64 (89)	72
2007	11 (15)	61 (85)	72
2008	11 (14)	66 (86)	77
First records total	18 (8)	195 (92)	213
Second records total	16 (24)	51 (76)	67

$p < 0.001$

Table 2: Association of the length of stay to the acquisition of heterophyid infection among Japanese residents of Egypt (2005-2008)

Length of stay (years)	First records		
	Positive (%)	Negative (%)	Total
<1	2 (3)	58 (97)	60
1-	8 (13)	55 (87)	63
2-	4 (11)	34 (89)	38
3-	3 (19)	13 (81)	16
4-	0 (0)	1 (100)	1
5-	1 (3)	32 (97)	33
unknown	0 (0)	2 (100)	2
Total	18 (8)	195 (92)	213

$p = 0.057$

fection among Japanese residents of Egypt. Positivity rate in new residents (length of stay < 1 year) was 3% (2/60) as

Table 3: Heterophyid conversion rates among new Japanese residents of Egypt (2005-2008)

First records	Second records		Total
	Negative	Positive	
Negative	18	7	25
Positive	1	1	2
Total	19	8	27

compared to 13% (8/63) among residents staying longer (1 year period of stay < 2 years). The difference between the two rates was of borderline significance ($p=0.057$).

Conversion of heterophyid infection among new residents

Paired records of new residents were selected to estimate positive conversion rates. Out of 60 records on new residents, 27 residents provided second stool samples (Fig.1). Table 3 shows that out of 25 new residents who were negative in the first records, only 7 showed heterophyid eggs upon examination of the second samples. Thus, positive conversion was observed in 28% (7/25) of new negative residents (Table 3).

DISCUSSION

Prevalence rates of heterophyid infection among Japanese residents of Egypt were 11% in 2005, 11% in 2006, 15% in 2007 and 14% in 2008. The present study covered 7-8% of Japanese residents registered at Japanese consulates in Egypt [9].

The study subjects were Japanese residents mainly consisting of Japanese expatriates and their families, or Japanese immigrants. Japanese expatriates usually stay in developing countries for less than 5 years [10]. The study included 33 residents who had stayed more than 5 years in Egypt but among whom positivity was as low as 3%. The other subjects were Japanese expatriates and their families, including a few students. Positivity among new residents staying for less than one year was 3%. This rate was found to increase with the length of stay, that is, 13% among residents in their second year and 11% among residents in their third year.

A positive conversion of 28%, 1-2 years later, was observed among new residents who had been found to be negative in first records. It is evident that Japanese expatriates and their families who stayed more than a year were exposed to a greater risk of heterophyid infection. *H. heterophyes* begins producing eggs in about 9 days and lives for only a few months to less than a year [11]. It is known that the prevalence of heterophyid metacercariae among Tilapia fish was the highest in summer [12]. Therefore, inves-

tigations on seasonal changes in the infection among Japanese residents of Egypt are recommended to make a clearer picture of the situation.

We conclude that the prevalence of heterophyid infection among Japanese residents of Egypt was still high. This study revealed a positive association between the length of stay in Egypt and infection. In other words, Japanese expatriates and their families who stay for more than a year in Egypt are exposed to a greater risk of infection with a positivity rate of 13%. The positivity rate among new residents as well as immigrants was only 3%.

REFERENCE

- 1 . Fukushima S, Okuzawa E, Marui E, Hamada A. The prevalence of intestinal parasites among Japanese expatriates living in developing countries, 2004. JJOMT 2010; 58: 94-9.
- 2 . Piekarski G. Heterophyes heterophyes. Lehrbuch der Parasitologie. Berlin: Springer-Verlag; 1954. p.257-8.
- 3 . Taraschewski H. Investigation on the prevalence of Heterophyes species in twelve populations of the first intermediate host in Egypt and Sudan. J Trop Med Hyg 1985; 88: 265-71.
- 4 . Elsheikha HM, Elshazly AM. Host-dependent variations in the seasonal prevalence and intensity of heterophyid encysted metacercariae (Digenea Heterophyidae) in brackish water fish in Egypt. Vet Parasitol 2008; 153: 65-72.
- 5 . Abou-Basha, LM, Abdel-Fattah M, Orecchia P, Di Cave D, Zaki A. Epidemiological study of heterophyiasis among humans in an area of Egypt. East Mediterr Health J 2000; 6: 932-8.
- 6 . Hamada A, Okuzawa E, Ujita Y, Hondo K, Ohkubo N, Nishikawa T, Basugi N. Changes in the prevalence of intestinal parasites among Japanese expatriates in developing countries. Kansenshogaku Zasshi 2003; 77: 138-145.
- 7 . Okuzawa E, Hamada A, Fukushima S, Koga S, Suzuki T, Kino H, Nakashima H, Sakusai Y. Risk factor of *Heterophyes* infection among Japanese expatriates at Cairo (Egypt), 2005-2008. J Natl Def Med Coll 2010; 35: 134-9.
- 8 . Allen AVH, Ridley DS. Further observations on the formol-ether concentration technique for faecal parasites. J Clin Pathol 1970; 23: 545-6.
- 9 . Ministry of foreign affairs. Annual report of statistics on Japanese nationals overseas 1 October 2008 (in Japanese), MOFA Japan 2009
Available from: <http://www.mofa.go.jp/mofaj/toko/tokei/hojin/09/pdfs/1.pdf>
- 10 . The Japan Institute for Labour Policy and Training. Results of the Seventh Survey of the Careers and Daily Lives of Employees on Overseas Assignment. (in Japanese) JILPT Research Series No.40, 2008
Available from: <http://www.jil.go.jp/institute/research/2008/documents/040/040.pdf>
- 11 . Maguire JH: Intestinal flukes. In: Mandell GL, Benett JE and Dolin R (ed.). Mandell, Douglas, and Benetts Principles

ples and practice of infectious diseases. 7th ed. Philadelphia: Churchill Livingstone; 2010, p.3602

- 12 . Lobna SM, Metawea YF, Elsheikha HM. Prevalence of heterophyiasis in Tilapia fish and humans in Northern Egypt. Parasitol Res 2010; 107:1029-34.