

# SEROPREVALENCE OF TOXOPLASMOSIS AMONG MIGRANT WORKERS FROM DIFFERENT ASIAN COUNTRIES WORKING IN MALAYSIA

BTE Chan<sup>1</sup>, RN Amal<sup>1</sup>, MI Noor Hayati<sup>1</sup>, H Kino<sup>2</sup>, N Anisah<sup>1</sup>, M Norhayati<sup>1</sup>, O Sulaiman<sup>1</sup>, M Mohammed Abdullah<sup>1</sup>, MS Fatmah<sup>1</sup>, AR Roslida<sup>1</sup> and G Ismail<sup>1</sup>

<sup>1</sup>Department of Parasitology and Medical Entomology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia; <sup>2</sup>Department of Parasitology, Hamamatsu University School of Medicine, Hamamatsu, Japan

**Abstract.** A serologic study of *Toxoplasma* antibodies among 501 foreign migrant workers in Malaysia was conducted in a plantation and detention camp. The highest prevalence rate of 46.2% was among Nepalese workers. Statistical analysis indicated the IgG positivity rate among local residents was significantly higher than the migrants studied ( $p < 0.05$ ). The IgM positivity rate showed no significant difference between the two groups ( $p > 0.05$ ). No significant difference in the prevalence rate was noted between the migrants and the local workers when grouped by agricultural and non-agricultural occupations ( $p > 0.05$ ). The continuous introduction of these infections may influence the epidemiology and further compromise efforts in control and prevention. It is therefore important to monitor of non-notifiable diseases.

## INTRODUCTION

*Toxoplasma gondii* is a protozoan parasite that is endemic worldwide and is a major opportunistic pathogen in immunocompromised hosts. Infection is mainly acquired by ingestion of food, water or soil that is contaminated with oocysts shed by cats, or by eating undercooked or raw meat containing tissue cysts (Fayer *et al*, 2004). Primary infection is usually subclinical, but in severely immunocompromised patients it may be life-threatening, (Montoya and Liesenfeld, 2004). Most clinical laboratories use serological tests to detect antibodies against *T. gondii* such as the latex agglutination (LA) test, ELISA and indirect fluorescent antibody test because of

their high specificity and sensitivity (Fan *et al*, 2006).

Seroprevalence in different populations may vary according to differences in environment, social customs and habits (Gibson and Coleman 1958; Conrad *et al*, 2005). Analysis of worldwide reports indicates about 38.5% of humans, 32.9% of cats, and 24.2% of goats were seropositive for infection (Samad and Begum, 1990; Dubey *et al*, 2006). Most primary infections become chronic infections in which the parasite persists in tissue cysts, mainly in the brain, retina, skeletal and cardiac muscles (Ho-Yen, 2005). In immunologically competent hosts, asymptomatic infection may remain undiagnosed until or unless it is reactivated as a result of severe immune suppression (Pradhan *et al*, 2007).

The arrival of migrant workers to Malaysia since the 1980s has raised the concern that some formerly unknown diseases may be inadvertently brought into the country. This is evident from the documented findings of im-

Correspondence: Amal R Nimir, Department of Parasitology and Medical Entomology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia.

Tel: 03 40405411; Fax: 03 26982640

E-mail: aralmadi@yahoo.com

ported non-endemic diseases, such as kala azar (Hamidah *et al*, 1995) and taeniasis (Che Ghani and Fatmah, 1996). The results of a recent survey of parasitic diseases among migrant workers showed a high prevalence of other non-notifiable infections, including toxoplasmosis (Personal observations). For this reason a survey of toxoplasmosis among foreign arrivals was undertaken.

## MATERIALS AND METHODS

### Study site and subjects

An isolated oil palm plantation in a rural setting was selected as the study site. The various areas of the plantation are linked by well-maintained dirt roads. There is no readily accessible public transport to the outside. The basic medical needs of the residents taken care of by a health clinic maintained by the employers. The survey involved 501 foreigners, some of whom had been issued permits by government authorities to work on the plantation and some had entered the country without legal papers. They were randomly selected from a detention camp located at the fringes of the rubber plantation. For comparison, the study included 198 local Malaysian workers (90 living and working on the plantation where the survey was conducted and 108 police and immigration personnel serving at the detention camp).

### Serologic studies

A seroprevalence study was conducted on sera from a single collection of blood samples. After separation, the serum was heat-inactivated at 56°C for 30 minutes, and followed by clarification by centrifugation. The samples were initially screened for *Toxoplasma* IgG antibody by the immunofluorescent antibody test (IFAT). A significant titer was defined as 1:64 and above. Positive samples were further titrated at two-fold dilutions to end-point.

All serum samples were also tested for IgM antibody by captured enzyme-linked

immunosorbant assay (ELISA). The samples were diluted to 1:100. Absorbance of the wells was read within 15 minutes of the end of the assay at 450 nm against the reference wavelength at 620 nm. Statistical analyses were carried out by using chi-square for significance at a 95% confidence level.

## RESULTS

Regardless their countries of origin, the overall distributions of *Toxoplasma* IgG and IgM antibodies in the migrants were compared to the local residents. Of the 501 migrants examined, 171 (34.1%) were found positive for IgG, and 26 (5.2%) were positive for IgM. Among the local residents, the positivity rates for IgG and IgM were 89 (44.9%) and 17 (8.6%), respectively. Statistical analysis indicates the IgG positivity rate in the local residents was significantly higher than in the migrants studied ( $p=0.009$ ). The IgM positivity rate was not significantly different between the two groups ( $p=0.179$ ).

The distribution of antibodies among the migrant subjects was further grouped according to their countries of origin (Table 1).

Table 2 shows the IgG titers for the subjects testing positive for toxoplasmosis. Both the illegal migrants and the local subjects had median titer of 256, whereas the legal migrant workers had a slightly lower median titer of 192. In all three study groups, the mode titers were set at 64, and all positive readings were in the 64 to 4,096 range. Comparatively high median titers were noted among the illegal migrants from Bangladesh (3 of the serum samples remained positive at a serum dilution of 1:1,024) and Myanmar (same mode titer was observed in 3 of the seven IgG-positive migrants). All three Africans and 4 Nepalese were positive for toxoplasmosis at a serum dilution of 1:2,048.

To investigate any possible relationship between the acquisition of toxoplasmosis and

Table 1  
Distribution of *Toxoplasma* IgG and IgM antibodies by country of origin.

Country of origin	Number of samples	IgG-positive	IgM-positive
		Number (%)	Number (%)
Africa	3	3 (100.0)	0 (0.0)
Nepal	26	12 (46.2)	3 (11.5)
Indonesia	336	138 (41.1)	20 (5.9)
Myanmar	22	7 (31.8)	3 (13.6)
Bangladesh	45	7 (15.5)	0 (0.0)
India	45	3 (6.7)	0 (0.0)
Pakistan	17	1 (5.9)	0 (0.0)
Sri Lanka	3	0 (0.0)	0 (0.0)
Thailand	3	0 (0.0)	0 (0.0)
China	1	0 (0.0)	0 (0.0)
Malaysia	198	89 (44.9)	17 (8.6)

Table 2  
Distribution of *Toxoplasma* IgM in relation to IgG among migrants and locals.

Group	IgM and IgG +ve		IgG +ve only	
	Number	IgG titer range/ mode	Number	IgG titer range/ mode
<b>Migrants</b>				
Plantation	7 (13%)	32-4,096, 64	47 (87%)	64-4,096, 64
Camp	14 (12%)	64-6,096, 512	98 (84%)	64-4,096, 64
<b>Locals</b>				
Plantation	6 (13%)	256-2,048, 1,024	40 (83%)	64-1,024, 512
Camp	6 (15%)	64-4,096, 256	32 (78%)	64-2,048, 64

occupation, the illegal migrants were grouped according to their occupational activities prior to arriving in Malaysia or before being detained in the detention camp. A majority of these migrants were involved in farming activities in their home countries, while the rest were in non-agricultural activities (data not shown). Since the legal migrant workers had been in the plantation for about 3.5 years on average, their occupations were defined according to the nature of work at the time when the survey was undertaken. For the purpose of this investigation, occupations that involved agricultural activities included planting, harvest-

ing, weeding and general maintenance of the plots. Non-agricultural occupations essentially included activities in processing and production in the oil palm mills, and other general jobs like transportation, repair and maintenance. Statistical analysis did not established a significant difference in infection rates between those who worked in the field and those who engaged in non-agricultural activities ( $p > 0.05$ ), (Table 3). Similarly, no significant difference in infection rates was observed between the local workers in agricultural and non-agricultural activities in the same place ( $p > 0.05$ ).

Table 3  
 Samples testing positive for toxoplasmosis antibodies in relation to occupations of the migrants and local workers.

Occupation	Migrants		Local workers		Total workers	
	Total tested	Positive samples	Total tested	Positive samples	Total tested	Positive samples
Agriculture	260	96 (36.9%)	56	31 (55.4%)	316	127 (40.2%)
Non-agriculture	241	75 (31.1%)	142	58 (40.8%)	383	133 (34.7%)
p-value		0.18		0.07		0.20

## DISCUSSION

The results of the present study show that nearly all nationalities examined for *Toxoplasma* antibodies were seropositive. In East and Southeast Asia, the seroprevalence of *T. gondii* infection is generally lower than that reported in Europe and the Americas (Bhatia *et al*, 1974; Dubey, 1994; Sukthana, 2006). The variations in prevalence rates among migrants from different countries of origin are most likely due to differences in dietary habits, behavioral risks, environmental conditions, socioeconomic status and hygiene.

Although all three migrants from Africa were found to harbor infection, the small sample size does not permit extrapolation of results to other African migrants. The different countries of origin for these three migrants also prevent a meaningful conclusion from being established (data not shown).

A high seroprevalence rate (46.2%) was found among Nepalese workers. In 1999, Rai *et al* found 65.3% of inhabitants studied in western Nepal were positive for toxoplasmosis. The major contributing factor to such a high prevalence was attributed to the habitual ingestion of minced raw meat or insufficiently cooked meat by some ethnic groups.

Toxoplasmosis is one of the most frequently observed food-borne diseases reported in Indonesia, with as many as 75% of animals

examined in 12 provinces in 1991 being seropositive (Kusharyono and Sukartinah, 1991). In our study, the seroprevalence rate was 54.4% among illegal Indonesian workers.

The negative findings among workers from Sri Lanka may be due to religious reasons since they are Budi (vegetarian). On the other hand, the negative findings among workers from Thailand and China may be due to the small number of studied subjects.

Since IgG titers generally decline 6 to 8 weeks after the initial infection with *T. gondii*, the significantly high titers in some of these workers suggests a recent exposure to the infection. This finding supports the theory that transmission occurred on the plantation. These observations hint at the theory that toxoplasmosis is transmitted more frequently in the living quarters of illegal migrants than it was to those being housed outside.

Certain occupations pose a higher risk for infection with *Toxoplasma gondii*. In a study by Rai *et al* (1999), it was noted that a higher prevalence was found among those engaged in agricultural activities where exposure to cat feces was not uncommon. However, the results of the present study on the plantation did not indicate any significant difference in the prevalence rates between those who were engaged in agricultural and non-agricultural occupations. This may be due to the fact that although non-agricultural workers were not

directly involved in agricultural pursuits, they were confined in the same environment where toxoplasmosis is being actively transmitted, which would subject them to the same risk for infection.

#### ACKNOWLEDGEMENTS

The authors wish to thank Universiti Kebangsaan Malaysia and Hamamatsu University for making possible this collaborative project. Special thanks is extended to the authorities and staff of the Immigration Department for the assistance and cooperation granted during the course of the study. This project was supported by a Japanese Monbusho Grant.

#### REFERENCES

- Bhatia VN, Meenakshi K, Aggarwal SC. Toxoplasmosis in South India, a serological study. *Indian J Med Res* 1974; 62: 1818-25.
- Che Ghani M, Fatmah MS. A case of taeniasis saginata in an immigrant worker from Myanmar. *Trop Biomed* 1996; 13: 123-32.
- Conrad PA, Miller MA, Kreuder C, *et al.* Transmission of *Toxoplasma*: Clues from the study of sea otters as sentinels of *Toxoplasma gondii* flow into the marine environment. *Int J Parasitol* 2005; 35: 1155-68.
- Dubey JP. Toxoplasmosis. *J Am Vet Med Assoc* 1994; 205: 1593-98.
- Dubey JP, Su C, Cortés JA, *et al.* Prevalence of *Toxoplasma gondii* in cats from Colombia, South America and genetic characterization of *T. gondii* isolates. *Vet Parasitol* 2006; 141: 42-7.
- Fan CK, Hung CC, Su KE, *et al.* Seroprevalence of *Toxoplasma gondii* infection among pre-schoolchildren aged 1 to 5 years in the Democratic Republic of Sao Tome and Principe, Western Africa. *Trans R Soc Trop Med Hyg* 2006; 100: 446-9.
- Fayer R, Dubey JP, Lindsay DS. Zoonotic protozoa; from land to sea. *Trends Parasitol* 2004; 20: 531-6.
- Gibson CL, Coleman N. The prevalence of *Toxoplasma* antibodies in Guatemala and Costa Rica. *Am J Trop Med Hyg* 1958; 7: 334-8.
- Hamidah NH, Cheong SK, Abu Hassan J. A case of kala azar diagnosed by bone marrow aspiration. *Malaysian J Pathol* 1995; 17: 39-42.
- Ho-Yen DO. Toxoplasmosis. *Medicine* 2005; 33: 120-1.
- Kusharyono C, Sukartinah S. The current status of food-borne parasitic zoonoses in Indonesia. *Southeast Asian J Trop Med Public Health* 1991; 22: 8-10.
- Pradhan S, Yadav R, Mishra VN. Toxoplasma meningoencephalitis in HIV-seronegative patients: clinical patterns, imaging features and treatment outcome. *Trans R Soc Trop Med Hyg* 2007; 101: 25-33.
- Rai SK, Matsumura T, Ono K, *et al.* High *Toxoplasma* seroprevalence associated with meat-eating habits of locals in Nepal. *Asia-Pacific J Public Health* 1999; 11: 89-93.
- Montoya JG, Liesenfeld O. Toxoplasmosis. *Lancet* 2004; 363: 1965-76.
- Samad MA, Begum N. Epidemiological and clinical status of toxoplasmosis in man and animals. *Bangladesh Vet* 1990; 7: 50-4.
- Sukthana Y. Toxoplasmosis: beyond animals to humans. *Trends Parasitol* 2006; 22: 137-42.