

# EPIDEMIOLOGY OF *BLASTOCYSTIS HOMINIS* AND OTHER INTESTINAL PARASITES IN A VIETNAMESE FEMALE IMMIGRANT POPULATION IN SOUTHERN TAIWAN

Hung-Shiang Cheng,<sup>1</sup> Zi-Fun Haung,<sup>1</sup> Wu-Hsiang Lan,<sup>2</sup> Tsung-Cheng Kuo,<sup>1</sup> and Jyh-Wei Shin<sup>3</sup>

<sup>1</sup>Department of Clinical Laboratory Science, Kuo's General Hospital, Tainan,

<sup>2</sup>Department of Clinical Laboratory Science, Yuan's General Hospital, Kaohsiung, and

<sup>3</sup>Department of Parasitology, Institute of Microbiology and Immunology, Medical College,  
National Cheng Kung University, Tainan, Taiwan.

There has been a rapid increase in cross-border female marriage immigrants in Taiwan. In this study, 1,434 Vietnamese female marriage immigrants arriving between July 1998 and June 2001 were examined for intestinal parasites. Most (77.9%) of these women were 20–29 years of age. The prevalence of intestinal parasite infection was 37.7%, and the trend increased from 1999 to 2001 (statistically significant,  $p < 0.0001$ ), but decreased among age subgroups ( $p < 0.0001$ ). Among the 20 species of intestinal parasites found in this study, 10 species (27.8%) were transmitted via the fecal–oral route, 5 (14.6%) via the soil-mediated route, and 5 (0.7%) by food-borne infection. The prevalence of blastocystosis (20.4%) and hookworm (9.7%) remained high among this population. The results provide unprecedented information on intestinal parasitic infection among these immigrants in southern Taiwan and recommend that appropriate health care be given after parasite infection is confirmed in these migrant communities.

**Key Words:** female marriage immigrants, *Blastocystis hominis*, intestinal parasite, prevalence, southern Taiwan  
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There has been a rapid increase in cross-border female marriage immigrants in Taiwan. According to the annual reports from the Department of Statistics, Ministry of the Interior, R.O.C., there were 139,735 foreign marriage immigrants. Excluding mainland Chinese, the five largest Asian female marriage immigrant populations in Taiwan until the end of 2002 were: Vietnamese, 81,320; Indonesian, 20,224; Thai, 11,526; Filipino, 7,109; and Cambodian, 4,628. Because parasitic infections and other infectious diseases are very common in these tropical countries [1,2], these

marriage immigrants, and other laborers who came to Taiwan because of a labor shortage, probably lived in similar hygienic conditions before coming to Taiwan. Several studies have mentioned the prevalence of parasitic infection among foreign workers [3–5], but have rarely mentioned these marriage immigrants, who most likely have the same issues.

*Blastocystis hominis* is a parasitic protozoon with a worldwide distribution. It is especially common in tropical and subtropical countries. In general, reports from developing countries find a higher prevalence of *B. hominis* infections (approximately 30–50% of the population) than those from developed countries (approximately 1.5–10%), although exceptions do occur [6]. In prevalence studies based on the entry physical examination, infection with *B. hominis* had the highest prevalence of parasites detected among these foreign workers in Taiwan [3,7].

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Address correspondence and reprint requests to: Dr. Jyh-Wei Shin, Department of Parasitology, Institute of Microbiology and Immunology, National Cheng Kung University, No. 1, Dashiue Road, Dung Chiu, Tainan, 701, Taiwan.  
E-mail: hippo@mail.ncku.edu.tw

This is the first study of the prevalence of *B. hominis* and other intestinal parasites in Vietnamese female marriage immigrants in Taiwan.

## MATERIALS AND METHODS

### Sampling

This study was carried out from July 1998 to June 2001. All subjects were examined at Yuan's General Hospital, one of the hospitals designated to perform such examinations in southern Taiwan, and the study population was Vietnamese female marriage immigrants who were required to take a complete physical examination for their residence approval.

### Intestinal parasite examination

Examination for intestinal parasites used the merthiolate-iodine-formaldehyde concentration method [8]. Each stool specimen was also examined for confirmation by the direct wet-mount method under low-field (100×) and high-power (400×) microscopy.

### Statistical analysis

All of the results were entered into EXCEL software (Microsoft, USA) and analyzed by JMP (SAS Institute, USA).  $\chi^2$  test was used to test for statistical significance.

## RESULTS

A total of 1,434 Vietnamese female marriage immigrants were included in this study, and the majority of these were aged 20–29 years. The overall prevalence of intestinal parasite infection was 37.7% in these immigrants: 23.4% for infection with a single parasite, 9.3% for infection with two parasites, and 5.0% for infection with more than two parasites.

A total of 261 subjects were examined in 1999, 358 in 2000, and 815 in 2001; the prevalence of intestinal parasite infections among these subjects increased annually (1999, 25.7%; 2000, 36.6%; and 2001, 42.1%;  $p < 0.0001$ ). However, the prevalence of intestinal parasite infection of age subgroups decreased with statistical significance ( $< 20$  years old, prevalence = 51.2%; 20–29 years old, 37.9%; and  $> 30$  years old, 22.6%;  $p < 0.0001$ ) (Table 1). The younger age group of these immigrants had a higher prevalence, and this prevalence increased annually in all age groups.

Of the 20 species of intestinal parasites found in this study, the prevalence of intestinal parasite infection transmitted via the fecal–oral route was 27.8% (10 species: *B. hominis*, *Endolimax nana*, *Entamoeba hartmanni*, *Entamoeba coli*, *Entamoeba histolytica/Entamoeba dispar*, *Giardia lamblia*, *Gongylonema pulchrum*, *Hymenolepis nana*, *Iodamoeba butschlii*, and *Sarcocystis hominis*); via soil-mediated route, 14.6% (5 species: *Ascaris lumbricoides*, hookworm, *Strongyloides stercoralis*, *Trichostrongylus orientalis*, and *Trichuris trichiura*); and via food-borne infection, 0.7% (5 species: Echinostomatidae, *Eurytrema pancreaticum*, *Fasciolopsis buski*, *Metagonimus yokogawai*, and *Opisthorchis viverrini/Clonorchis sinensis*).

Of the protozoas and helminthes infections in the immigrants, the prevalence of blastocystosis (20.4%) and hookworm infection (9.7%) remained the highest. Comparison of the finding of the 10 major intestinal parasites among age groups and by annual prevalence showed that *B. hominis* and hookworm had a higher prevalence in the youngest age group ( $< 20$  years), and that this prevalence increased annually. *E. histolytica*, *E. dispar*, and *E. coli* had a higher prevalence of infection in the younger age group, and *E. nana* and *E. hartmanni* infection prevalence increased annually and was statistically significant ( $p < 0.05$ ) (Table 2).

**Table 1.** Prevalence of intestinal parasites among female marriage immigrants from Vietnam in southern Taiwan

Age group (yr)	Number examined (number positive, %) by year				<i>p</i>
	1999	2000	2001	Total	
$< 20$	9 (3, 33.3)	15 (7, 46.7)	138 (73, 52.9)	162 (83, 51.2)	0.48
20–29	219 (59, 26.9)	289 (111, 38.4)	609 (253, 41.5)	1,117 (423, 37.9)	0.0005
$\geq 30$	33 (5, 15.2)	54 (13, 24.1)	68 (17, 25.0)	155 (35, 22.6)	0.49
Total	261 (67, 25.7)	358 (131, 36.6)	815 (343, 42.1)	1,434 (541, 37.7)	$< 0.0001$
<i>p</i>	0.27	0.08	0.0005	$< 0.0001$	

**Table 2.** Prevalence of infection with most common intestinal parasites among age subgroups and annual subgroups of female marriage immigrants from Vietnam in southern Taiwan

Intestinal parasite	Number positive (%) by age subgroup				<i>p</i>	Number positive (%) by year subgroup				<i>p</i>
	< 20 yr	20–29 yr	> 30 yr	Total		1999	2000	2001	Total	
	( <i>n</i> = 162)	( <i>n</i> = 1,117)	( <i>n</i> = 155)	( <i>n</i> = 1,434)		( <i>n</i> = 261)	( <i>n</i> = 358)	( <i>n</i> = 815)	( <i>n</i> = 1,434)	
<i>Blastocystis hominis</i>	44 (27.2)	228 (20.4)	20 (12.9)	292 (20.4)	0.006	22 (8.4)	75 (21.0)	195 (23.9)	292 (20.4)	< 0.0001
Hookworm	23 (14.2)	110 (9.9)	6 (3.9)	139 (9.7)	0.004	12 (4.6)	37 (10.3)	90 (11.0)	139 (9.7)	0.0036
<i>Endolimax nana</i>	15 (9.3)	71 (6.4)	5 (3.2)	91 (6.4)	ns*	7 (2.7)	19 (5.3)	65 (8.0)	91 (6.4)	0.0032
<i>Entamoeba hartmanni</i>	15 (9.3)	51 (4.6)	6 (3.9)	72 (5.0)	ns*	5 (1.9)	17 (4.8)	50 (6.1)	72 (5.0)	0.0118
<i>Entamoeba coli</i>	11 (6.8)	53 (4.7)	1 (0.7)	65 (4.5)	0.006	12 (4.6)	9 (2.5)	44 (5.4)	65 (4.5)	ns*
<i>Trichostrongylus orientalis</i>	0 (0.0)	6 (0.5)	0 (0.0)	63 (4.4)	ns*	6 (2.3)	14 (3.9)	43 (5.3)	63 (4.4)	ns*
<i>Trichuris trichiura</i>	6 (3.7)	33 (3.0)	5 (3.2)	44 (3.1)	ns*	9 (3.5)	11 (3.1)	24 (2.9)	44 (3.1)	ns
<i>Entamoeba histolytica</i> / <i>Entamoeba dispar</i>	10 (6.2)	28 (2.5)	0 (0.0)	38 (2.7)	0.001	4 (1.5)	4 (1.1)	30 (3.7)	38 (2.7)	0.0133
<i>Ascaris lumbricoides</i>	0 (0.0)	15 (1.3)	1 (0.7)	16 (1.1)	ns*	3 (1.2)	4 (1.1)	9 (1.1)	16 (1.1)	ns*
<i>Giardia lamblia</i>	3 (1.9)	7 (0.6)	1 (0.7)	11 (0.8)	ns*	0 (0.0)	5 (1.4)	6 (0.7)	11 (0.8)	ns*

\*Not significant ( $p > 0.05$ ).

## DISCUSSION

Very little is known about the mode of transmission and pathogenicity of *B. hominis*, and the trophozoites and cysts of *B. hominis* are easily distorted in wet mounts. The misdiagnosis that results has allowed this protozoan to be ignored as a cause of human infection. Although the pathogenicity of this parasite remains controversial, clinical findings of infection with *B. hominis* include diarrhea, abdominal pain, nausea, cramps, fecal leukocytes, rectal bleeding, eosinophilia, hepatomegaly, splenomegaly, cutaneous rashes, itching [6], and irritable bowel syndrome [9]. Some asymptomatic carriers have lower leukocytes, neutrophils, hemoglobin, and hematocrit levels [3].

Intermarriage between persons from different cultures and regions is a comparatively new social phenomenon in Taiwan. Advances in technology and more frequent interaction between persons have resulted in an increase in such intermarriages. Overall, 541 (37.7%) of the Vietnamese female marriage immigrants in this study were found to have one or more intestinal parasites. This percentage was significantly higher than that found for the Southeast Asian laborers (15.1%) in the first-time entry examination [4]. Foreign laborers were examined for intestinal parasitic infection before they left their countries and also during routine twice-per-year physical examinations by the government during their stay in Taiwan. Foreign spouses had no physical examination before registering for

permanent residence. This finding indicates that intestinal parasitic infections were generally neglected among this migration population.

*B. hominis* has been the most frequently identified parasite, with a prevalence of 18.1% in foreign workers in southern Taiwan [10]. Similar results were found in this study, with a prevalence of *B. hominis* in all age groups (20.4%) of Vietnamese female marriage immigrants. Previous studies showed that *B. hominis* could also be a possible intestinal pathogen from frequent contact in travelers and foreign workers, because they undoubtedly acquired the infection via the fecal–oral route [11,12]. *B. hominis* can be transmitted as a cyst by the fecal–oral route [6]. In this study, most of the identified intestinal parasites were acquired via the fecal–oral route (27.8%) and *B. hominis* was usually the culprit, both with single- and multiple-parasite infections.

Within 3 days of entrance into Taiwan, all foreign workers are required to have a complete physical examination, which includes a stool examination for parasites and parasite eggs. Unlike these foreign workers, the female marriage immigrants usually took the same physical examination 6 months after entry for their residence approval. Unlike the foreign workers, the marriage immigrants were not only working for their employers but also working and living with their families. As a result of the 6-month delay before an obligatory physical examination, the female marriage immigrants who are *B. hominis* carriers could infect a

parasite-free family. Moreover, recent studies have shown that the number of people infected with *B. hominis* increased with the frequent close contact within the environment of occupational and residential sanitation. Family members with gastroenteritis caused a family outbreak of blastocystosis [13], and Peace Corps volunteers, working in areas where blastocystosis was endemic, faced a similarly high risk of infection [12]. Furthermore, marriage immigrants are usually more socially active and travel domestically more than the foreign workers do. Thus, the government should be deeply concerned about the possibility of an outbreak of blastocystosis.

Recent studies have revealed that the predominant pattern of intestinal parasitic infections among foreign workers has changed from soil transmission to oral–fecal transmission, and *B. hominis* infection has become the most important parasitic disease among foreign workers in Taiwan [7]. As their stay in the army base lengthens, the prevalence of blastocystosis has been noted to increase [14]. Because of its easy transmissibility and high prevalence, *B. hominis* could be transmitted among the marriage immigrants' family members and their indigenous population as a result of previous hygiene practices and similar climate environment. The possibility of family blastocystis outbreaks should be further studied.

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## REFERENCES

1. Saksirisampant W, Wiwanitkit V, Akkrabovorn P, Nuchprayoon S. Parasitic infections in Thai workers that pursue overseas employment: the need for a screening program. *Southeast Asian J Trop Med Public Health* 2002;33 (Suppl 3):110–2.
2. Verle P, Kongs A, De NV, et al. Prevalence of intestinal parasitic infections in northern Vietnam. *Trop Med Int Health* 2003;8:961–4.
3. Cheng HS, Guo YL, Shin JW. Hematological effects of *Blastocystis hominis* infection in male foreign workers in Taiwan. *Parasitol Res* 2003;90:48–51.
4. Wang LC. Parasitic infections among Southeast Asian labourers in Taiwan: a long-term study. *Epidemiol Infect* 1998;120:81–6.
5. Peng HW, Chao HL, Fan PC. Imported *Opisthorchis viverrini* and parasite infections from Thai labourers in Taiwan. *J Helminthol* 1993;67:102–6.
6. Stenzel DJ, Boreham PFL. *Blastocystis hominis* revisited. *Clin Microbiol Rev* 1996;9:563–84.
7. Wang LC. Changing patterns in intestinal parasitic infections among Southeast Asian laborers in Taiwan. *Parasitol Res* 2004; 92:18–21.
8. Sapero JJ, Lawless DK. The MIF stain-preservation technique for the identification of intestinal protozoa. *Am J Trop Med Hyg* 1953;2:613–9.
9. Giacometti A, Cirioni O, Fiorentini A, et al. Irritable bowel syndrome in patients with *Blastocystis hominis* infection. *Eur J Clin Microbiol Infect Dis* 1999;18:436–9.
10. Cheng HH, Huang YH, Huang MJ, et al. Epidemiological survey of *Blastocystis hominis* infections among alien laborers in southern Taiwan. *6th Asian-Pacific Congress for Parasitic Zoonoses, Taipei*, 2000:81–94.
11. Jelinek T, Peyerl G, Loscher T, et al. The role of *Blastocystis hominis* as a possible intestinal pathogen in travellers. *J Infect* 1997;35:63–6.
12. Herwaldt BL, de Arroyave KR, Wahlquist SP, et al. Multiyear prospective study of intestinal parasitism in a cohort of Peace Corps volunteers in Guatemala. *J Clin Microbiol* 2001;39:34–42.
13. Guglielmetti P, Cellesi C, Figura N, Rossolini A. Family outbreak of *Blastocystis hominis* associated gastroenteritis. *Lancet* 1989;2(8676):1394.
14. Taamasri P, Leelayoova S, Rangsin R, et al. Prevalence of *Blastocystis hominis* carriage in Thai army personnel based in Chonburi, Thailand. *Mil Med* 2002;167:643–6.

# 台灣南部地區女性婚姻移民的人芽囊原蟲與其它腸道寄生蟲之流行病學調查

鄭鴻祥<sup>1</sup> 黃子芳<sup>1</sup> 藍武祥<sup>2</sup> 郭宗正<sup>3</sup> 辛致煒<sup>4</sup>

<sup>1</sup>郭綜合醫院 檢驗科 <sup>2</sup>阮綜合醫院 檢驗科 <sup>3</sup>郭綜合醫院 院長

<sup>4</sup>國立成功大學 寄生蟲學科 微生物與免疫學研究所

在台灣，海外女性婚姻移民在近年來迅速地增加，本研究係針對在 1998 年至 2001 中的 1,434 位來自越南的女性婚姻移民檢查其腸道寄生蟲感染狀態。多數的女性婚姻移民的年齡在 20–9 歲 (77.9%)。研究結果發現，在這些女性婚姻移民中，腸道寄生蟲的盛行率為 37.7%。且從 1999 年到 2001 顯著地隨著年度增加 ( $p < 0.0001$ )，同時，年齡越低的女性婚姻移民有較高的腸道寄生蟲的盛行率 ( $p < 0.0001$ )。本研究共發現 20 種腸道寄生蟲的類別，其中有 10 種 (27.8%) 經由糞口途徑感染，5 種 (14.6%) 是經由土壤媒介感染，5 種 (0.7%) 是經由食物媒介感染。人芽囊原蟲 (20.4%) 與鉤蟲 (9.7%) 分別位居腸道寄生蟲感染中的原蟲及蠕蟲類別的首位。本研究結果提供了南台灣地區女性婚姻移民的腸道寄生蟲感染狀之系統性資訊，同時，研究結果建議對於寄生蟲感染的女性婚姻移民應提供更適合的健康照護。

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通訊作者：辛致煒副教授

國立成功大學寄生蟲學科、微生物與免疫學研究所

台南市東區 701 小東路一號