Prevalence of *Strongyloides stercoralis* Infection in Northeastern Thailand (Agar Plate Culture Detection)

PRAPHASRI JONGSUKSUNTIGUL, MD, MPH*,
THITIMA WONGSAROJ, PhD*,
SERI SINGTHONG, BSc****,
WANCHAI MALEEWONG, PhD**
PEWPAN M INTAPAN, MD, MSc**,
SOMSAK NILPAN, MSc***,
SUPRANEE VEERAKUL, BSc*****,

Abstract

The prevalence of *Strongyloides stercoralis* infection was studied in the rural and urban populations of 19 provinces of Northeastern Thailand. A total of 1233 fecal samples was collected from July to September 2002 and examined using agar plate culture method. The overall prevalence of *S. stercoralis* was 23.5 per cent with the highest infection rate in Kalasin Province (61.0%), predominantly among 60 year olds and older (28.0%), and in males (32.8%). The factors associated with *Strongyloides* infection were sex (males) and age (the over 19 year-old age group).

Conclusion : *S. stercoralis* infection remains highly prevalent among the population of northeastern Thailand as confirmed by the agar plate culture method. The authors recommend that a program for effective strongyloidiasis control should have a justifiable priority.

Key word : *Strongyloides stercoralis*, Northeastern Thailand, Agar Plate Culture

**JONGSUKSUNTIGUL P,
INTAPAN PM, WONGSAROJ T, et al
J Med Assoc Thai 2003; 86: 737-741**

* Bureau of General Communicable Diseases, Department of Disease Control, Ministry of Public Health, Nonthaburi 11000,
** Department of Parasitology, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002,
*** Offices of Prevention and Control Diseases Region V,
**** Offices of Prevention and Control Diseases Region VI,
***** Offices of Prevention and Control Diseases Region VII, Department of Disease Control, Ministry of Public Health, Nonthaburi 11000, Thailand.

Intestinal helminthic diseases are a serious threat to public health in Thailand[1,2]. Among the intestinal parasitic diseases, strongyloidiasis is one of the public health problems[3]. The clinical spectrum of strongyloidiasis varies from asymptomatic infection, to mild symptomatic abdominal and skin diseases, to fatal disseminated infections in immunosuppressed patients[4]. The reported prevalences of *Strongyloides stercoralis* infection in Thailand are difficult to ascertain and may be underestimated because of low larval densities in the feces[5] and inadequate diagnostic methods (i.e. the simple direct smear, formalin ether concentration and Kato's thick smear methods)[1,6]. Agar-plate culture of the feces using a modified petri dish has proved to be highly efficient in the detection of *Strongyloides stercoralis* infection[7-10]. However, scientifically assessed data about *S. stercoralis* infection among the human population of the northeastern part of Thailand is still lacking. This survey was carried out to determine the current status of intestinal helminthic infection in populations of 19 provinces of Northeastern Thailand, with special reference to *Strongyloides* using the more sensitive and specific agar plate culture method.

MATERIAL AND METHOD

Study area and subjects

The study area comprised all provinces (Table 1) of Northeastern Thailand. The calculated number of samples to be studied was 1200. Stool samples were taken by sampling 30 randomized clusters. Each cluster consisted of approximately 40 randomized samples for stool examination. The randomized clusters were serially situated in Muang Nakhon Ratchasima, Chok Chai, Pak Thong Chai and Soeng Sang districts of Nakhon Ratchasima Province, Phu Khieo district of Chaiyaphum Province, Sikhoraphum and Chumpon Buri districts of Surin Province, Nang Rong and Ban Kruat districts of Buri Ram Province, Borabu district of Maha Sarakham Province, Ban Fang and Chum Phae districts of Khon Kaen Province, Kham Muang district of Kalasin Province, Wanon Niwat district of Sakon Nakhon Province, Muang Udon Thani and Nam Som districts of Udon Thani Province, Muang Nong Bua Lum Phu district of Nong Bua Lum Phu Province, Erawan district of Loei Province, Phon Phisai district of Nong Khai Province, Muang Nakhon Phanom district of Nakhon Phanom Province, Wan Yai district of Mukdahan Province, Maha Chana Chai district of Yasothon Province, Changhan and Nong Phok districts of Roi Et Province, Khukhan and Phayu districts of Si Sa Ket Province, Warin Chamrap, Trakan Phutphon, Lao Sueu Kok districts of Ubon Ratchathani Province, and Lue Amnat district of Amnat Charoen Province. The age of the subjects was obtained by questionnaire. The study protocol was approved by the Scientific-Ethical Committee of Khon Kaen University. Informed consent was obtained from the study subjects using a standard approved procedure.

Stool examination by agar plate culture method

One stool sample was collected from each of the 1233 subjects from July to September 2002. *Strongyloides* infection was determined by agar plate culture method for which approximately 3 g of feces were placed in the center of a nutrient agar plate during field studies, kept in a box (at room temperature) during transportation to the laboratory and incubated for 5 days at room temperature[10]. The agar plate was examined under a stereomicroscope for the presence of tracks from moving larvae or free living adults on the 3rd and 5th day. All microscopically positive dishes were further processed by washing the surface of the agar with a 10 per cent formalin solution to collect as many worms as possible. The collected worms were identified for observation on worms otherwise hidden. Differentiation of *S. stercoralis* and hookworm larvae was performed under 40x microscopic magnification.

Statistical analysis

Quantitative data and questionnaire information were analyzed by descriptive statistics using SPSS for Windows version 11.0 (SPSS Inc., Chicago, Illinois, USA). The consistency of associations was determined by odds ratio.

RESULTS

Among the 1233 stool samples examined, the prevalence of *S. stercoralis* infection was 23.5 per cent. The age of all participants ranged from 5 to 82 years with a mean ± SD of 41.9 ± 14.9 years. The highest prevalence of *S. stercoralis* infection was found in Kalasin province (61.0%) and among 60 year-olds and older (28.0%) (Tables 1 and 2). The prevalence was higher in males (32.8%) than females (16.0%). Factors associated with *S. stercoralis* infection were male sex and age groups over 19 years (Table 2). In addition, 69 (5.6%) of 1,233 samples presented

Table 1. *Strongyloides stercoralis* infection rates in Northeastern Thailand by province.

Provinces	No. positive/total	%
Nakhon Ratchasima	22/150	14.7
Chaiyaphum	6/45	13.3
Surin	13/79	16.4
Buri Ram	11/75	14.7
Maha Sarakham	12/40	30.0
Khon Kaen	14/85	16.5
Kalasin	25/41	61.0
Sakon Nakhon	8/43	18.6
Udon Thani	16/82	19.5
Nong Bua Lam Phu	12/40	30.0
Loei	14/42	33.3
Nong Khai	8/35	22.8
Nakhon Phanom	8/40	20.0
Mukdahan	13/40	32.5
Yasothon	11/42	26.2
Roi Et	28/87	32.2
Si Sa Ket	23/87	26.4
Ubon Ratchathani	31/135	23.0
Amnat Charoen	15/45	33.3
Total	290/1,233	23.5

filariform hookworm larvae. Co-infection of *S. stercoralis* and hookworm was demonstrated in 18 cases (1.5%).

DISCUSSION

The present study indicates that *S. stercoralis* remains highly prevalent (23.5% of all subjects) among populations in Northeastern Thailand. Jongsuksuntigul et al[1] reported the rate of 0.2 per cent among the inhabitants of Northeastern Thailand. This previous study[1] might have underestimated the true prevalence of helminthic infections because of the low sensitivity of the method used (i.e. Kato's thick smear technique) for detecting *Strongyloides* larvae The authors propose that the present results may more truly reflect the actual prevalence because the agar plate culture method used in this study was more sensitive[8,11,12].

The prevalence determined in the present study was correlated to recent surveys in other populations of Thailand[13,14]. Sukhavat et al[13] reported an infection rate of 24.5 per cent in Northern Thailand and Wilairatana et al[14] reported a positive rate of 14.1 per cent in Thai laborers working abroad Factors associated with *S. stercoralis* infection were male sex and age over 19 years. However, Hall et al [15] demonstrated that *S. stercoralis* infection was associated with those aged from 7 to 10 years in an urban slum in Dhaka, Bangladesh. The association between male sex and *S. stercoralis* infection was similar to a previous study (men, relative risk = 3.9) [16]. In addition, Arakaki et al[17] reported that the *S. stercoralis* infection rate was high in those aged over 40 years.

The high infection rate in males could be because males usually work abroad, out of doors and are frequently exposed to the *S. stercoralis* infective stage[16]. This reason explains why men have a high-risk to parasitic infection. The infection rate was also high among the older population which is probably due to the high reinfection rate without treatment in the endemic area and the habit of high-risk behavior. Moreover, individuals in this age group seem to be less aware of sanitation. Interestingly, the highest prevalence rate was found in Kalasin Province. This result could be due to the low standard of sanitation in the suburbs and rural areas. Environmental contamination with the infective stage is high and individuals who do not wear shoes are likely to become infected with frequent exposure.

Table 2. *Strongyloides stercoralis* infection rates by age and sex.

Variables	No. of positive/total	%	OR	95% CI for OR
Age (years)				
< 19	17/110	15.4	1	
20-29	24/117	20.5	1.41	0.71-2.79
30-39	65/286	22.7	1.60	0.89-2.89
40-49	86/340	25.3	1.85	1.04-3.28
50-59	56/230	24.3	1.76	0.97-3.20
≥ 60	42/150	28.0	2.12	1.13-3.98
Sex				
Male	181/551	32.8	2.57	1.97-3.41
Female	109/682	16.0	1	

Evidently *S. stercoralis* is still highly prevalent in many parts of Thailand. The present results justify the implementation of a priority program for effective strongyloidiasis control including improving sanitary practices in order to prevent soil-transmitted helminthic infections.

ACKNOWLEDGEMENTS

The Department of Disease Control, Ministry of Public Health, supported this study. The authors wish to thank Dr. Mark Roselieb and Dr. Thanawat Imsomboom for improving the English-language presentation of the manuscript.

(Received for publication on February 4, 2003)

REFERENCES

1. Jongsuksuntigul P, Chaeychomsri W, Techamontrikul P, Jeradit P, Surathanavanit P. Study on prevalence and intensity of intestinal helminthiasis and opisthorchiasis in Thailand. J Trop Med Parasitol 1992; 15: 80-95.
2. Jongsuksuntigul P, Imsomboon T, Teerarat S, Suruthanavanith P, Kongpradit K. Consequences of opisthorchiasis control programme in northeastern Thailand. J Trop Med Parasitol 1996; 19: 24-39.
3. Pearson RD. An update on the geohelminths: *Ascaris lumbricoides*, Hookworm, *Trichuris trichiura*, *Strongyloides stercoralis*, Curr Infect Dis Rep 2002; 4: 59-64.
4. Singh S. Human strongyloidiasis in AIDS era: Its zoonotic importance. J Assoc Physicians India 2002; 50: 415-22.
5. Genta RM. Global prevalence of strongyloidiasis : Critical review with epidemiologic insights into the prevention of disseminated disease. Rev Infect Dis 1989; 11: 755-67.
6. Tesjaroen S. The prevalence of *Strongyloides stercoralis* in Thailand. Siriraj Hosp Gaz 1989; 41: 641-2.
7. Arakaki T, Iwanaga M, Kinjo F, Saito A, Asato R, Ikeshiro T. Efficacy of agar plate culture in detection of *Strongyloides stercoralis* infection. J Parasitol 1990; 76: 425-8.
8. Kaminsky RG. Evaluation of three methods for laboratory diagnosis of *Strongyloides stercoralis* infection. J Parasitol 1993; 79: 277-80.
9. Koga K, Kasuya S, Khamboonruang C, et al. An evaluation of the agar plate method for detection of *Strongyloides stercoralis* in northern Thailand. J Trop Med Hyg 1990; 93: 183-8.
10. Koga K, Kasuya S, Khamboonruang C, et al. A modified agar plate method for detection of *Strongyloides stercoralis*. Am J Trop Med Hyg 1991; 45: 518-21.
11. Sato Y, Kobayashi J, Toma H, Shiroma Y. Efficacy of stool examination for detection of *Strongyloides* infection. Am J Trop Med Hyg 1995; 53: 248-50.
12. Jongwutiwes S, Charoenkorn M, Sitthicharoenchai P, Akaraborvorn R, Putaporntip C. Increased sensitivity of routine laboratory detection of *Strongyloides stercoralis* and hookworm by agar plate culture. Trans R Soc Trop Med Hyg 1999; 4: 398-400.
13. Sukhavat K, Morakote N, Chaiwong P, Piangjai S. Comparative efficacy of four methods for the detection of *Strongyloides stercoralis* in human stool specimens. Ann Trop Med Parasitol 1994; 88: 95-6.
14. Wilairatana P, Radomyos P, Radomyos B, et al. Intestinal sarcocystosis in Thai laborers. Southeast Asian J Trop Med Public Health 1996; 27: 43-6.
15. Hall A, Conway DJ, Anwar KS, Rahman ML. *Strongyloides stercoralis* in an urban slum community in Bangladesh: Factors independently associated with infection. Trans R Soc Trop Med Hyg 1994; 88: 527-30.
16. Davidson RA, Fletcher RH, Chapman LE. Risk factors for strongyloidiasis. A case-control study. Arch Intern Med 1984; 144: 321-4.
17. Arakaki T, Iwanaga M, Asato R, Ikeshiro T. Age related prevalence of *Strongyloides stercoralis* in Okinawa, Japan. Trop Geogr Med 1992; 44: 229-303.

ความชุกของพยาธิ *สตรองจีย์ลอยดีส สเตอร์โคระลีส* ในภาคตะวันออกเฉียงเหนือประเทศไทย (โดยการตรวจด้วยวิธีจานวุ้นเพาะเลี้ยง)

ประภาศรี จงสุขสันติกุล, พบ, สม, ผิวพรรณ (มาลีวงษ์) อินต๊ะพันธุ์, พบ, วทม**, ฐิติมา วงศาโรจน์, ปรด*, สมศักดิ์ นิลพันธ์, วทบ***, เสรี สิงห์ทอง, วทบ****, สุปราณี วีรกุล, วทบ*****, วันชัย มาลีวงษ์, ปรด***

โดยสำรวจความชุกของการติดเชื้อ พยาธิ*สตรองจีย์ลอยดีส สเตอร์โคระลีส* (Strongyloides stercoralis) ในประชากรในเมืองและชนบท จาก 19 จังหวัดของภาคตะวันออกเฉียงเหนือประเทศไทยโดยตรวจอุจจาระของประชากรทั้งหมด 1,233 ราย ระหว่างเดือนกรกฎาคมถึงเดือนกันยายน 2545 ด้วยวิธีจานวุ้นเพาะเลี้ยง (Agar plate culture) พบว่ามีความชุกทั้งหมดของพยาธิร้อยละ 23.5 โดยมีความชุกสูงสุดที่จังหวัดกาฬสินธุ์ร้อยละ 61.0 กลุ่มประชากรอายุมากกว่า 60 ปีร้อยละ 28.0 และในเพศชายร้อยละ 32.8 ปัจจัยที่มีความสัมพันธ์กับเป็นโรคพยาธิคือเพศชายและมีอายุมากกว่า 19 ปี

โดยสรุปการติดเชื้อพยาธิยังมีความชุกสูงในประชากรในภาคตะวันออกเฉียงเหนือของประเทศไทย และโครงการควบคุมโรคติดเชื้อพยาธิ*สตรองจีย์ลอยดีส สเตอร์โคระลีส* ควรพิจารณาดำเนินการก่อน

คำสำคัญ : *สตรองจีย์ลอยดีส สเตอร์โคระลีส*, ภาคตะวันออกเฉียงเหนือ ประเทศไทย, วิธีจานวุ้นเพาะเลี้ยง

ประภาศรี จงสุขสันติกุล, ผิวพรรณ (มาลีวงษ์) อินต๊ะพันธุ์, ฐิติมา วงศาโรจน์, และคณะ จดหมายเหตุทางแพทย์ ฯ 2546; 86: 737–741

* กองโรคติดต่อทั่วไป, กรมควบคุมโรค, กระทรวงสาธารณสุข, นนทบุรี 11000
** ภาควิชาปรสิตวิทยา, คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น, ขอนแก่น 40002
*** สำนักงานป้องกันควบคุมโรคที่ 5,
**** สำนักงานป้องกันควบคุมโรคที่ 6,
***** สำนักงานป้องกันควบคุมโรคที่ 7, กรมควบคุมโรค, กระทรวงสาธารณสุข, นนทบุรี 11000