

INTESTINAL SARCOCYSTOSIS IN THAI LABORERS

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Abstract. To determine the prevalence of *Sarcocystis* and other intestinal parasites in Thai laborers who were going abroad for work, stool examinations of 362 asymptomatic laborers were studied. The four most frequently parasites found in stool were *Sarcocystis* sp (23.2%), *Opisthorchis viverrini* (40.3%), hookworm (21.5%), and *Strongyloides stercoralis* (14.1%). *Giardia intestinalis* (5.2%), *Entamoeba coli* (1.7%), *Endolimax nana* (2.5%), *Blastocystis hominis* (4.1%), *Echinostoma* sp (3.6%), *Trichuris trichiura* (0.3%), *Taenia* sp (1.7%), *Hymenolepis nana* (0.6%), and *Enterobius vermicularis* (0.3%) were present at low rates. *Sarcocystis* were frequently found in male laborers (83.3%) ($p < .01$). The laborers from northeastern Thailand ($n = 278$) had a higher prevalence (26.6%) of *Sarcocystis* infection ($p < .01$). This study shows that Thai laborers, particularly from northeastern Thailand, are commonly infected with intestinal parasites. The high prevalence rates of *Sarcocystis* and other intestinal parasites in this study were indicative of the local habit of eating raw beef and pork, poor living conditions, and low levels of hygiene in Thai laborers. Sarcocystosis could be a significant food-borne zoonotic infection in Thailand.

INTRODUCTION

Sarcocystis is a tissue coccidian with an obligatory two-host life cycle. The two forms of sarcocystosis affecting man are intestinal and muscular sarcocystosis. The sexual generations of gametogony and sporogony occur in the lamina propria of the small intestine of definitive hosts which shed infective sporocysts in their stools and present with intestinal sarcocystosis. Asexual multiplication occurs in the skeletal and cardiac muscles of intermediate hosts which harbor *Sarcocystis* cysts in their muscles and present with muscular sarcocystosis.

Man is an intermediate host of some unknown *Sarcocystis* sp and a definitive host of two known species, *Sarcocystis hominis* with an ox-man cycle and *Sarcocystis suihominis* with a pig-man cycle. The clinical findings of intestinal sarcocystosis vary from asymptomatic to severe diarrhea. Six cases including one fatal case of intestinal sarcocystosis presenting with enteritis were reported from Thailand (Bunyaratvej *et al*, 1982). The fatal patient had necrotizing ileitis. In view of lack of specificity and transient nature of the symptoms in most cases of naturally-acquired human infection it would have been missed if there was no deliberate effort to specifically detect sporocysts in the feces

of human subjects. The clinical significance of sarcocystosis depends upon the magnitude of the infection, and that this correlates inversely with underlying immune competence (Cook, 1990). However the exact prevalence rate of human intestinal sarcocystosis is not known among asymptomatic Thai people. We therefore studied the prevalence of intestinal sarcocystosis and other intestinal parasitic infections in Thai laborers.

MATERIALS AND METHODS

From April to August 1995, 362 Thai laborers came to Hospital for Tropical Diseases, Bangkok, Thailand for physical check-up before travelling abroad as contract laborers. These laborers came from all over Thailand. Apart from optional interviews and physical examinations, laboratory tests including HIV antibody test and stool examinations using a formalin-ether concentration procedure were performed. All HIV seronegative laborers with parasitic infections were completely treated with anti-parasitic drugs before travelling abroad. Quantitative data were presented as means \pm standard deviations and differences between means were compared by using Student's *t* test. Quantitative data were compared by using Chi-squared test with

Yates's correction or Fisher's exact test as appropriate. P values less than 0.05 were regarded as statistically significant.

RESULTS

All laborers were physically healthy, asymptomatic and appeared fit for work abroad. Sixty-eight percent of the laborers were male. The average age of the laborers was 30.31 ± 06.54 years (range 18-46 years). The age of male laborers (30.66 ± 6.95 years) was not significant different from that of females (29.31 ± 5.50). Most of them were local laborers (41.7%) and farmers (44.2%) (Table 1). The laborers came from many regions of Thailand, however, the northeastern laborers (76.8%) were predominant. Four frequently parasites found in stools were *Opisthorchis viverini*, *Sarcocystis* sp, hookworm, and *Strongyloides stercoralis*. One hundred and twenty-two laborers (33.7%) had multiple intestinal parasitic infections. There were 4 laborers with asymptomatic HIV infection.

Of 362 laborers, sarcocystosis was found in 84 laborers (23.2%). Apart from *Opisthorchis viverini*, *Sarcocystis* infection (n = 74) was frequently found in the northeastern laborers (n = 278) (p < .01) (Table 2). More male laborers (n = 70) had *Sarcocystis* infection than females (n = 14) (p < .01). There was no significant difference of sarcocystosis infection rates among 5 occupations and 6 age groups. However, the infection was frequently found in both groups of laborers who were previ-

ously local laborers and farmers. *Sarcocystis* sp in stools were less frequently demonstrated in laborers younger than 20 or older than 40 years old.

DISCUSSION

This study shows that Thai laborers, particularly from the northeastern Thailand are commonly infected with *Sarcocystis* sp and other intestinal parasites. Sarcocystosis is more predominant in males than in females, possibly due to a large number of male laborers travelling abroad. However, the prevalence of *Sarcocystis* and other intestinal parasites found in the study is almost certainly an underestimate because in all laborers only a single stool sample was determined.

The high prevalence rates of *Sarcocystis* sp, *Opisthorchis viverini*, hookworm infection, and *Strongyloides stercoralis* in this study which are predominantly transmitted via the fecal-oral route, are indicative of poor living conditions and low standards of hygiene in those laborers. Moreover, exotic culinary practices (such as eating raw or undercooked meat), particularly in northeastern Thailand, may play role in contributing to sarcocystosis and other intestinal parasitic infections. The low prevalence of sarcocystosis in laborers aged less than 20 and greater than 40 years may not be a true figure of all Thai laborers in these age groups because only a small number of laborers in both age groups travelled abroad. Although the laborers had different occupations before being

Table 1
Demographic characteristics of Thai laborers (n = 362).

Age group (years)	n (%)	Location*	n (%)	Previous occupation**	n (%)
< 20	11 (3.0%)	Central	51 (14.1%)	Local laborers	151 (41.7%)
20-24	68 (18.8%)	Northeastern	278 (76.7%)	Farmers	160 (44.2%)
25-29	86 (23.8%)	North	31 (8.6%)	Housekeepers	11 (3%)
30-34	92 (25.4%)	East	1 (0.3%)	Business	5 (1.4%)
35-39	78 (21.5%)	South	1 (0.3%)	None	35 (9.7%)
> 39	27 (7.5%)				

* According to 5 regions in Thailand

** Occupations before being contract laborers

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Table 2
Parasites detected in Thai laborers.

Parasites*	Northeastern laborers (n = 278)	All laborers (n = 362)
<i>Sarcocystis</i> sp	74 (26.6%)	84 (23.2%)
<i>Opisthorchis viverrini</i>	118 (42.4%)	146 (40.3%)
Hookworm	65 (23.4%)	78 (21.5%)
<i>Strongyloides stercoralis</i>	43 (15.5%)	51 (14.1%)
<i>Giardia intestinalis</i>	15 (5.4%)	19 (5.2%)
<i>Entamoeba coli</i>	5 (1.8%)	6 (1.7%)
<i>Endolimax nana</i>	7 (2.5%)	9 (2.5%)
<i>Blastocystis hominis</i>	12 (4.3%)	15 (4.1%)
<i>Echinostoma</i> sp	12 (4.3%)	13 (3.6%)
<i>Trichuris trichiura</i>	1 (0.4%)	1 (0.3%)
<i>Taenia</i> sp	6 (2.2%)	6 (1.7%)
<i>Hymenolepis nana</i>	2 (0.7%)	2 (0.6%)
<i>Enterobius vermicularis</i>	1 (0.4%)	1 (0.3%)

* Many laborers had multiple parasitic infections.

contract laborers, there was no significant difference in sarcocystic infection. The reason is possibly due to similar poor living conditions and low standards of hygiene of the laborers even with different occupations.

An overall seroprevalence of sarcocystosis in Malaysia was 19.7% (Thomas and Dissanaik, 1978), with the highest prevalence rate reported among Aborigines (39.7%), followed by Malays (17%), Indians (8.7%), and Chinese (3.6%). While seropositivity for *Sarcocystis* antibodies could not differentiate between intestinal or muscular sarcocystosis, the Malaysian survey indicated that at least one in five individuals examined had been exposed to *Sarcocystis* parasites. Our study shows a similar result that one in five Thai laborers had intestinal sarcocystosis.

There are several reasons why intestinal sarcocystosis is a relatively obscure disease: the parasites are small and easily overlooked, stain poorly, and evoke little or no tissue response. So far, human sarcocystosis reported in Thailand consists of the intestinal form only, with man serving as a definitive host (Bunyaratvej *et al*, 1982). All patients had enteritis. However, both forms of sarcocystosis, particularly intestinal sarcocystosis, can become a potentially serious public health prob-

lem if the sources of infection (sporocysts and sarcocysts) are not controlled or monitored. This is especially so in view of the fact that seemingly harmless or innocuous zoonotic infections caused by *Toxoplasma gondii*, *Pneumocystis carinii*, and the intestinal protozoan, *Cryptosporidium* sp, have been shown to be severe and even fatal among immunosuppressed patients, especially those with the acquired immunodeficiency syndrome (AIDS). Sarcocystosis is self-limited disease. Chemotherapy for *Sarcocystis* sp is needed in those with a diminished immune response (Cook, 1990). It is possible for the mild and transient form of intestinal sarcocystosis to become protracted, prolonged, and disseminated among immunosuppressed individuals who may not necessarily have AIDS but may have been subjected to immunosuppressive therapy for other disease conditions. In view of the current frequent use of immunosuppressive therapy, it becomes mandatory to thoroughly screen all patients for sporocysts in the feces before initiating such chemotherapeutic regimens (Kan and Pathmanathan, 1991).

Intestinal sarcocystosis could easily occur wherever there is unsanitary disposal of human and animal waste. Such conditions of poor environmental sanitation prevail in all socio-economically disadvantaged communities in both rural and urban

areas of Thailand, particularly in the northeastern region. The ease of transmission of infection, especially the intestinal form (by eating raw or uncooked meat) further enhances the potential of sarcocystosis to be a major food-borne zoonotic infection in this country.

ACKNOWLEDGEMENTS

We thank staff of Hospital for Tropical Diseases and staff of Bangkok School of Tropical Medicine for their help. Support for the study was obtained from Hospital for Tropical Diseases, Faculty of Tropical Medicine, Mahidol University, Thailand.

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