A Cross-Sectional Survey of Intestinal Helminthiases in Rural Communities of Nakhon Ratchasima Province, Thailand

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Background: *The public-health problems caused by intestinal helminthic infections have been neglected in rural areas where there remains a lack of hygiene and an inadequate supply of sanitary water.*
Objective: *This research was to study the infection rate of intestinal helminthiases and socioeconomic data within two communities in Nakhon Ratchasima province.*
Material and Method: *Intestinal helminthiases were examined using Kato's Thick Smear technique and socio-demographic data was collected using predesigned semi-structured questionnaires.*
Results: *209 stool samples were collected from 83 male and 126 female participants. Stool examinations showed that 6.22% (13/209) of study participants were infected with intestinal helminths, predominantly hookworm (4.31%, 9/209) followed by Strongyloides stercolaris (1.44%, 2/209), and Taenia sp. (0.48%, 1/209). Males were slightly more likely to be infected than females. Intestinal helminthic infection was more commonly found in the 61-70 year age group and positively associated with occupation of agriculture. The Tanod sub-district had an intestinal helminthiases rate of 10.59%, higher than in the Wang Sai sub-district. In conclusion, this study shows that intestinal helminthic infections are common parasitic infections among patients presenting for a small scale survey of a rural Thai community.*
Conclusion: *This information may provide invaluable statistics needed for planning meaningful public control programs that aim at reducing the prevalence and morbidity of parasitic infections. Large scale surveys and health education are urgently required.*

Keywords: *Intestinal helminthiases, Rural community, Nakhon Ratchasima, Thailand*

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Worldwide, more than 2 billion people are infected with at least one parasitic species[1]. Parasitic infections, particularly intestinal helminthiases, cause hundreds of thousands of avoidable deaths each year, and are among the world's most common infectious diseases. Intestinal helminthiases are more prevalent in the tropics, and especially among poor communities. Records show trends of increasing helminthic infections, particularly in developing nations[2-5]. The public-health problems caused by intestinal helminthic infections have been neglected in rural areas where there remains a lack of hygiene and an inadequate supply of sanitary water. However, a recent research has shown that intestinal helminthic infections can produce significant morbidity including bloody stool, chronic diarrhea, and abdominal pain[6]. Intestinal helminthic infections are the most common human parasitic infections, especially in rural areas of Thailand[7-9]. The objective of this research was to study the infection rate of intestinal helminthiases within two communities in Nakhon Ratchasima province. There are very little reported data on intestinal helminthic infections among the people in Nakhon Ratchasima. However, the prevalence of *Opisthorchis viverrini* infection in cyprenoid fish in this area has been reported and shown to be quite high in some districts[10]. There

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is a lack of data on the current status of intestinal helminthiases in Nakhon Ratchasima. Therefore, we performed a pilot project with a small-scale survey to begin evaluating this. The Wang Sai sub-district of Pak Chong district and the Tanod sub-district of Mueang Nakhon Ratchasima were selected for this survey of intestinal helminthiases. The results of this study will be useful for researchers and health authorities for planning and implementing control programs of intestinal helminthic infections in the area

Material and Method

A community-based study was conducted among 209 people in Wang Sai sub-district of Pak Chong district (May 2012) and the Tanod sub-district (July 2013) of Mueang Nakhon Ratchasima, Thailand. A cross-sectional, parasitological questionnaire survey was carried out in Nakhon Ratchasima Province located in northeastern Thailand. The province has a total area of about 20,494 square kilometres, making it the biggest province in Thailand, located 259 kilometres away from Bangkok city by road. The study protocol was approved by the Suranaree University Ethical Review Committee. 209 villagers from both sub-districts, 91 male and 118 female were randomly selected. Necessary permission from the concerned authorities was obtained and a survey was conducted using a pre-tested semi-structured questionnaire. Prior informed consent was obtained. For those not available for the first interview, another visit was made to minimize non-responses. Stools were collected from individual villagers (who had completed the interview), kept in labeled plastic bags and then transported in the box to the laboratory at the Parasitic Disease Research Unit, department of Pathology, Institute of Medicine, Suranaree University of Technology, Thailand, within a day of collection.

The collected stool specimens were examined for intestinal helminthiases by the modified Kato thick smear procedure. The modified Kato thick smear was prepared and processed according to the method of Kato and Miura[11]. The materials used were prepared in accordance with standard laboratory in-house procedures. Thus, the glycerin-malachite green solution was mixed with 1 ml of 3% malachite green, 100 ml of 6% phenol and 100 ml of pure glycerin. The cellophane strips, each 22x40 mm, were soaked in this solution for at least 24 hours before use. Additionally, in order to eliminate fibers or seed, the technique was modified by pressing a 105-mesh stainless steel grid onto the sample which was then filtered, transferred to slides covered by the cellophane soaked cover slips and allowed to stand for 30 minutes. All preparations were initially screened with a low-power (10x) objective lens. Suspected parasitic objects were subsequently examined under a high-power (40x) objective. The stool samples were preserved in 10% formalin for later confirmation, if needed. Every positive case of intestinal helminthic infection identified by the modified Kato method was confirmed by two expert parasitologists before a definitive diagnosis was established. Patients who were found to be infected with parasites were treated with anti-parasitic drugs and attended health education. Statistical data analysis was carried out using the SPSS software version 12.0. Chi-square test was performed to determine the association between socio-demographic status and intestinal helminthic infection.

Results

The survey results are summarized in Table 1, 2. 209 fecal samples were collected to check for intestinal helminthiases; 124 samples were collected in Wang Sai sub-district and 85 samples in Tanod sub-district. It was found that the prevalence of intestinal helminthic infections among people in both communities was low, with an overall infection rate of only 6.22%. This comprised 4.31% *Hookworm* (Fig. 1A), 1.44% *Strongyloides stercoralis* (Fig. 1B), and 0.48% *Taenia sp* (Fig. 1C). In Wang Sai sub-district the overall infection rate was 3.23% (4/124) and in Tanod sub-district it was 10.59% (9/85) (Table 1). This result shows that the intestinal helminthic infections in Tanod sub-district were significantly higher than in Wang Sai sub-district ($p = 0.05$).

209 villagers (60.28% females and 39.72% males) participated in the survey. General characteristics of the population were shown in Table 2. The proportion of infected males (9.64%, 8/83) was slightly higher than the proportion of infected females (3.97%, 5/126) and the gender difference was statistically significant, $X^2 = 5.74$, $p = 0.05$. The prevalence of intestinal helminthic infection was higher in the 71-80 year-old group with a rate of 22.22% (2/9), followed by the 51-60 year-old group (17.72, 7/54), and the 31-40 year-old group (12.5, 3/24). No infections were found in the younger (<30 year old) and elderly (>80 year old) age groups (Table 2).

By occupation, intestinal helminthic infection was found more frequently among agriculture workers with a rate of 13.33% (10/75). Chi-square testing on occupations revealed that this association was significant ($X^2 = 6.43$, $p = 0.05$).

Table 1. Prevalence of human intestinal helminthiases in Wang Sai sub-district and Tanod sub-district, Nakhon Ratchasima province, Thailand

Location	No. of examined	No. of positive (%)	No. of infected (%)		
			Hookworm	*Strongyloides stercoralis*	*Taenia sp*
Wang Sai sub-district	124	4 (3.23)	2 (1.61)	2 (1.61)	0
Tanod sub-district	85	9 (10.59)*	7 (8.24)	1 (1.18)	1 (1.18)
Total	209	13 (6.22)	9 (4.31)	3 (1.44)	1 (0.48)

* $p<0.05$

Fig. 1 Intestinal helminthes collected from stool samples: egg of *hookworm* (A), rhabditiform larva of *Strongyloides stercoralis* (B) showing short buccal cavity and prominent genital primordium, and eggs of *Taenia* sp (C).

Table 2. Prevalence of human intestinal helminthiases in Wang Sai sub-district and Tanod sub-district, Nakhon Ratchasima Province, Thailand, by gender, age, and occupation

Categories	% (infected/examined)
Sex	
Male	9.64 (8/83)*
Female	3.97 (5/126)
Age	
<10	0 (0/20)
10-20	0 (0/12)
21-30	0 (0/5)
31-40	12.5 (3/24)
41-50	2.72 (1/44)
51-60	12.72 (7/54)
61-70	0 (0/24)
71-80	22.22 (2/9)*
81-90	0 (0/1)
>90	0 (0/16)
Occupation	
Agriculture	13.33 (10/75)*
Government Officer	0 (0/1)
Trade	0 (0/13)
House Wife	0 (0/6)
Employed	5.35 (3/56)
Student	0 (0/24)
Children	0 (0/4)
Unknown	0 (0/30)
Total	6.22 (13/209)

* statistical significant

Discussion

The present study showed that the overall prevalence of intestinal helminthiases was low in the Wang Sai sub-district at only 3.23%, but higher in Tanod sub-district at 10.59%. *Hookworm* was the most prevalent (4.31%), followed by *S. stercoralis* (1.44%), with *Taenia* spp being the least prevalent (0.48%). *Hookworm* and *S. stercoralis* are soil-transmitted helminths, and they were the most frequently detected helminth parasites in the present study. This is consistent with many other studies at various sites in Thailand[6,7,12-20]. However, in contrast to our study, the other research carried out in Sai Dong Young Village, Wang Yang Sub-district and Huay Bo Tong Village, Ban Mung Sub-district, and Noen Maprang District, Phitsanuloke province demonstrated a higher prevalence of *S. stercolaris* (9.58%) and hookworm infection (8.22%)[21]. Soil-transmitted helminths can induce chronic disease state. Hookworm larvae can enter through the skin of a host, typically on the foot,

and travel up through the bloodstream into the lungs. Hookworm disease can produce an itchy rash and coughing with or without bloody sputum. When present in the intestines, hookworm infection usually does not produce any recognizable symptoms. However, some people may experience diarrhea, abdominal pain, intestinal cramps, and nausea. Chronic or persistent hookworm can cause anemia due to blood loss, especially in people with poor health or in pregnant women[22]. The present study shows a low prevalence of intestinal helminthiases in Wang Sai sub-district and a higher prevalence of intestinal helminthiases in Tanod sub-district. The different prevalence rates of parasitic infection demonstrated in this study suggest that a cohort study could be constructed to compare between the life style of the villagers, the local health management, services from government, and the environments.

The proportion of infected males (9.64%) was slightly higher than the infection rate in females (3.97%). This result was similar to previous research and thought to be due to male with behavior and occupations. Analyses of data from annual surveillance of Thailand and some communities surveyed have shown a higher prevalence of *O. viverrini* infection in males than females[9,12]. In addition, data from a Phitsanulok Province cross sectional study in Ban Mung and Ban Chat Trakan villages have shown a higher prevalence of intestinal helminthic infection, *E. vermicularis*, in males than females[20]. The prevalence of intestinal helminthic infection was higher in the 71-80 year age group with 22.22%. In general, soil-transmitted helminthes are commonly found in schoolchildren however, our study was significantly different with no cases in the younger age groups. This may be due to their behavior, environment, and occupation. This study also indicates that intestinal helminthic infection was found frequently in agricultural workers with a prevalence of 13.33%. This study represents a prospective 'work in progress' and is intended to provide baseline information for future follow-up surveys to monitor infection (and especially re-infection in the population age group) rates. The next survey will include detailed information about the participants' knowledge, beliefs and behaviors relevant to intestinal helminthic infection.

Conclusion

In conclusion, the percentage of intestinal helminthic infections in Wang Sai sub-district was low but in Tanod sub-district was higher. This information may provide invaluable statistics needed for planning meaningful public control programs that aim at reducing the prevalence and morbidity of parasitic infections. Large-scale surveys and health education programs are urgently required.

What is already known on this topic?

The percentage of intestinal helminthic infections in Nakhon Ratchasima.

What this study adds?

The present study showed that the overall prevalence of intestinal helminthiases. This information may provide invaluable statistics needed for planning meaningful public control programs that aim at reducing the prevalence and morbidity of parasitic infections.

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Potential conflicts of interest

None.

References

1. de Silva NR, Brooker S, Hotez PJ, Montresor A, Engels D, Savioli L. Soil-transmitted helminth infections: updating the global picture. Trends Parasitol 2003; 19: 547-51.
2. Chan MS. The global burden of intestinal nematode infections—fifty years on. Parasitol Today 1997; 13: 438-43.
3. World Health Organization. Informal consultation on intestinal helminthes infection. (Document WHO/CDS/IPI/90.1). Geneva: WHO; 1990.
4. World Health Organization. Basic laboratory methods in medical parasitology. Geneva: WHO; 1991.
5. World Health Organization. Prevention and control of schistosomiasis and soil-transmitted helminthiasis. WHO technical report series 912. , Geneva: WHO; 2002.
6. Sinuon M, Anantaphruti MT, Socheat D. Intestinal helminthic infections in schoolchildren in Cambodia. Southeast Asian J Trop Med Public Health 2003; 34: 254-8.
7. Jongsuksuntigul P, Manatrakul D, Wongsaroj T, Krisanamara K, Sawatdimongkol S, Wongsaroj S. Evaluation of helminthiasis control program in

Thailand at the end of the 8th Health Development Plan 2001. J Trop Med Parasitol 2003; 26: 38-46.
8. Waikagul J, Jongsuksantigul P, Rattanawitoon U, Radomyos P, Kojima S, Takeuchi T. Parasitological monitoring of helminth control program in Northern Thailand. Southeast Asian J Trop Med Public Health 2008; 39: 1008-14.
9. Kaewpitoon N, Kaewpitoon SJ, Pengsaa P. Opisthorchiasis in Thailand: review and current status. World J Gastroenterol 2008; 14: 2297-302.
10. Kaewpitoon N, Kaewpitoon SJ, Ueng-arporn N, Rujirakul R, Churproong S, Matrakool L, et al. Carcinogenic human liver fluke: current status of Opisthorchis viverrini metacercariae in Nakhon Ratchasima, Thailand. Asian Pac J Cancer Prev 2012; 13: 1235-40.
11. Kato K, Miura M. Comparative examinations. Jpn J Parasitol 1954; 3: 35.
12. Upatham ES, Viyanant V, Brockelman WY, Kurathong S, Lee P, Chindaphol U. Prevalence, incidence, intensity and associated morbidity of intestinal helminths in south Thailand. Int J Parasitol 1989; 19: 217-28.
13. Muennoo C, Rojekittikhun W, Sanguankiat S, Maipanich W, Vorasanta P, Waikagul J. Prevalence and intensity of soil-transmitted helminthes in village with clustered housing and dispersed housing, Nakhon Si Thammarat Province. J Trop Med Parasitol 1998; 21: 40-3.
14. Piangjai S, Sukontason K, Sukontason KL. Intestinal parasitic infections in hill-tribe schoolchildren in Chiang Mai, northern Thailand. Southeast Asian J Trop Med Public Health 2003; 34 (Suppl 2): 90-3.
15. Anantaphruti MT, Waikagul J, Maipanich W, Nuamtanong S, Pubampen S. Soil-transmitted helminthiases and health behaviors among schoolchildren and community members in a west-central border area of Thailand. Southeast Asian J Trop Med Public Health 2004; 35: 260-6.
16. Tomono N, Anantaphruti MT, Jongsuksuntigul P, Thongthien P, Leerapan P, Silapharatsamee Y, et al. Risk factors of helminthiases among schoolchildren in southern Thailand. Southeast Asian J Trop Med Public Health 2003; 34: 264-8.
17. Saksirisampant W, Prownebon J, Kulkumthorn M, Yenthakam S, Janpla S, Nuchprayoon S. Prevalence of intestinal parasitic infections among school children in the central region of Thailand. J Med Assoc Thai 2006; 89: 1928-33.
18. Warunee N, Choomanee L, Sataporn P, Rapeeporn Y, Nuttapong W, Sompong S, et al. Intestinal parasitic infections among school children in Thailand. Trop Biomed 2007; 24: 83-8.
19. Kitvatanachai S, Boonslip S, Watanasatitarpa S. Intestinal parasitic infections in Srimum suburban area of Nakhon Ratchasima Province, Thailand. Trop Biomed 2008; 25: 237-42.
20. Vitta A, Polseela R, Bunchu N, Waree P, Thongwat D, Tangchaisuriya U, et al. Intestinal helminthiases in two communities of Phitsanulok Province, Northern Thailand. J Trop Med Parasitol 2012; 35: 1-5.
21. Waree P, Polseela P, Pannarunothai S, Pipitgool V. The present situation of paragonimiasis in endemic area in Phitsanulok Province. Southeast Asian J Trop Med Public Health 2001; 32 (Suppl 2): 51-4.
22. Gilles HM, Ball PAJ. Hookworm infections (human parasitic diseases). Vol. 4. Amsterdam: Elsevier; 1991: 38-3.

การสำรวจหนอนพยาธิลำไส้ในชุมชนแบบภาคตัดขวางในจังหวัดนครราชสีมา ประเทศไทย

สรญา แก้วพิทูลย์, ไรอัน เอ ลอยด์, ณัฏฐวุฒิ แก้วพิทูลย์

ภูมิหลัง: ปัญหาโรคหนอนพยาธิในลำไส้เป็นปัญหาทางสาธารณสุขที่สำคัญในชุมชนและสามารถติดต่อได้ง่ายจากอาหาร ดินและน้ำ

วัตถุประสงค์: เพื่อสำรวจการติดเชื้อหนอนพยาธิลำไส้และปัจจัยด้านสังคม เศรษฐนะในผู้ที่ติดเชื้อหนอนพยาธิในจังหวัดนครราชสีมา

วัสดุและวิธีการ: การสำรวจ ณ ช่วงเวลาใดเวลาหนึ่ง เพื่อศึกษากลุ่มตัวอย่างจากตำบลวังไทร อำเภอปากช่อง (ช่วงเดือนพฤษภาคม พ.ศ. 2555) และตำบลโตนด อำเภอเมือง (ช่วงเดือนกรกฎาคม พ.ศ. 2556) จังหวัดนครราชสีมา ตรวจหาหนอนพยาธิในลำไส้ด้วยวิธี Kato's Thick Smear และข้อมูลประชากรเก็บด้วยแบบสัมภาษณ์

ผลการศึกษา: จำนวนตัวอย่างทั้งหมด 209 ราย แบ่งเป็นเพศชาย 83 ราย เพศหญิง 126 ราย พบการติดเชื้อ 6.22% (13/209) โดยพบว่าพยาธิปากขอติดเชื้อมากที่สุด (4.31%, 9/209) ตามด้วยพยาธิสตรองจิรอยดิส สเตอร์โคลาริส (1.44%, 2/209) และพยาธิตัวตืด (0.48%, 1/209) ผู้ชายมีอัตราการติดเชื้อสูงกว่าผู้หญิง พบมากในกลุ่มอายุ 61-70 ปี กลุ่มอาชีพเกษตรกรรม อัตราการติดเชื้อในตำบลโตนดเท่ากับ 10.59% สูงกว่าตำบลวังไทร

สรุป: การศึกษาในครั้งนี้ชี้ให้เห็นว่าโรคหนอนพยาธิในลำไส้พบได้บ่อยในชุมชนตามชนบท แม้จะเป็นกลุ่มตัวอย่างเล็กๆ การศึกษานี้อาจจะเป็นข้อมูลพื้นฐานสำหรับนำไปวางแผนการดำเนินงานควบคุมโรคเพื่อลดความชุกและอัตราป่วยด้วยโรคติดเชื้อปรสิต การสำรวจในกลุ่มใหญ่และการให้สุขศึกษาก็มีความจำเป็นเร่งด่วน