Research Article

Epidemiology of Soil-transmitted Helminth Infections in Koodprao Village, Sakon-Nakhon Province, Thailand

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Abstract

Objective: To determine prevalence and some possible risk factors of soil-transmitted helminth infections in Koodprao village, Sakon-nakhon province, Thailand.

Method: A total of 561 fecal samples were examined by a direct simple smear and formalin-ethyl acetate concentration technique. To assess the possible risk factors, each subject was interviewed with the structured questionnaire and data were analyzed by Epi-info software.

Result: Soil-transmitted helminths found in 31.6 % of the samples were as follows : Hookworm 20.9 %, *Strongyloides stercoralis* 16.0 %, *Trichuris trichiura* 0.2 %. Among these samples *Ascaris lumbricoides* was not found. Risk factors for Hookworm infection were level of education, occupation, defecation behavior and location of latrine whereas those for *Strongyloides stercoralis* infection were gender and occupation.

Conclusion: Factors involved demographic data, defecation behavior and environmental sanitation should be considered in the design of long-term soil-transmitted helminth control in endemic areas.

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Keywords: Soil-transmitted helminth infection, prevalence, risk factors

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บทคัดย่อ: ระบาดวิทยาของการติดเชื้อหนอนพยาธิที่ติดต่อผ่านดิน ในหมู่บ้านกุดพร้าว จังหวัดสกลนคร ประเทศไทย

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วัตถุประสงค์: เพื่อศึกษาหาความชุกและปัจจัยส่งเสริมการติดเชื้อหนอนพยาธิที่ติดต่อผ่านดิน ในหมู่บ้านกุดพร้าว จังหวัดสกลนคร ประเทศไทย

วิธีการ: ทำการตรวจตัวอย่างอุจจาระของประชาชนจำนวน 561 ราย ด้วยวิธี Direct simple smear และ วิธี Formalin-ethyl acetate concentration technique พร้อมกับทำการสัมภาษณ์โดยใช้แบบสอบถามเพื่อนำข้อมูลที่ได้มาวิเคราะห์ทางสถิติด้วย Epi-info software

ผลการศึกษา: พบว่าความชุกของโรคหนอนพยาธิที่ติดต่อผ่านดินสูงถึงร้อยละ 31.6 แยกเป็น Hookworm, *Strongyloides stercoralis* และ *Trichuris trichiura* ร้อยละ 20.9, 16.0, และ 0.2 ตามลำดับ แต่ไม่พบ *Ascaris lumbricoides* นอกจากนี้ยังพบว่า ปัจจัยที่ส่งเสริมการติดเชื้อ Hookworm คือ ระดับการศึกษา อาชีพ พฤติกรรมการถ่ายอุจจาระ และตำแหน่งของส้วมที่บ้าน ในขณะที่ปัจจัยที่ส่งเสริมการติดเชื้อ *Strongyloides stercoralis* คือ เพศ และอาชีพ

สรุป: การศึกษาครั้งนี้ชี้ให้เห็นว่า ข้อมูลประชากร พฤติกรรมการถ่ายอุจจาระ และสุขาภิบาลสิ่งแวดล้อมนั้นเป็นสิ่งที่ควรคำนึงถึงและนำมาพิจารณาเพื่อหามาตรการควบคุมการติดเชื้อหนอนพยาธิที่ติดต่อผ่านดินในระยะยาว

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คำหัส: การติดเชื้อหนอนพยาธิที่ติดต่อผ่านดิน, ความชุก, ปัจจัยเสี่ยง

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Introduction

Soil-transmitted helminths (STH) comprise Hookworm, *Trichuris trichiura, Ascaris lumbricoides* and *Strongyloides stercoralis* are globally distributed, but the prevalence varied in each region.[1-7] The most important factors influencing the success of the control program has been postulated to be many factors concerning human behavior.

In Thailand, especially in rural commu-

nities, most of people in these areas are farmers and gardeners and they do not used to wear shoes during working in the field. Defecation in the field onto the ground is a common habit leading to the spread of STH. Although the control programs for this infection are implemented and effective drugs are available,[8,9] these programs have not significantly reduced the prevalence of parasitic infections.[10,11] The high prevalence rates and the poor progress of the control programs result in poor general health of the people and substantial economic loss to the country.

The aim of the present study was therefore to examine the prevalence of STH infection in Koodprao village, Sakon-Nakhon province, North-Eastern Thailand, and to assess the relationship between the prevalence and risk factors involved demographic data, defecation behavior and environmental sanitation. The results will lead to the understanding of epidemiology and can be incorporated into the planning of more effective control program for STH infection in this region.

Materials and Methods

Study Area and Sampling

The study was carried out during February to May 2000 in Koodprao village, Sakon-Nakhon province; a poor rural community in the North-Eastern of Thailand. There were 227 houses and 1005 inhabitants in this village. The village was chosen because the prevalence of STH infection is still high even our surveillance found its improved sanitary condition. Five hundred and sixty one subjects who lived in this village were randomly selected for the study.

Data Collection

Personal information, including gender, age, family size, occupation, income, level of education, knowledge concerning the transmission of STH and defecating behavior were collected from an interview of each subject by using a constructed questionnaire. Interviewers were thoroughly pre-oriented and clarified with the procedures of the study. Data on the location and cleanness of latrine were obtained by interviewers' observation.

Fecal Examination

Stool samples were collected from each subject. For this purpose, labeled plastic containers were distributed and the subjects were advised to collect the first stool sample of the day, preferably in the morning. Then preserved in 10% formalin and examined by direct simple smear and formalin-ethyl acetate concentration technique with a double reading of each sediment. Ova of Hookworm, *Trichuris trichiura, Ascaris lumbricoides* and larvae of *Strongyloides stercoralis* were sought.

Data Analysis

Results of the stool examination and the data from the questionnaires were complied and analyzed by using Epi-Info 6 Software.

Results

Prevalence of Soil-transmitted helminth infection

The demographic characteristics of the subjects are summarized in Table 1, whereas the prevalence of each of STH species observed is shown in Table 2. The overall prevalence of STH infection was considerably high (31.6%, 177/561). No case of *Ascaris lumbricoides* infection was found in this group. The predominant parasites found were Hookworm and *Strongyloides stercoralis* which higher infection rate was in the working age group; 15 to 64 years, than those in the school age group; 5 to 14 years (Figure 1). Mixed infections of Hookworm and *Strongyloides stercoralis* were observed in 10 male and 21 female.

Risk Factors for Soil-transmitted helminth infection

Certain groups of subjects were found to be more likely to acquire the infection (Table 3). Having an agricultural occupation carried the most important increased risk of Hookworm infection [odds ratio (OR)=3.15; 95% confidence interval (CI)=1.95-5.13] and *Strongyloides stercoralis* infection [odds ratio (OR)=2.44; 95% confidence interval (CI) = 1.45-4.14]. In this community, risk factors of Hookworm infection included irregularly defecating in a latrine and having a latrine outside the house. In contrast, having a minimum of a Bachelor's degree and having a latrine at field were associated with low risk. Another finding was that males had higher risk of *Strongyloides stercoralis* infection compared to females.

Table 1 Demographic characteristics of the population

Characteristic	Koodprao village
No. of inhabitants	1,005
Male: female ratio	1:1.04
Mean age (years)	32.1
% Having 1-4 people in family	47.4
Mode of income (Baht per month)	1,000
% Farmers and Gardeners	53.1
% Having a minimum of a Bachelor's degree	3.2
% Dependency ratio*	58.9

*; % Dependency ratio = $\frac{\text{Age (0-14)} + \text{Age (> 60)}}{\text{Age (15-59)}} \times 100$

Table 2 Prevalence of Soil-transmitted helminth infection in the subjects from Koodprao village.

Infection	Prevalence (%)		No. of Total (N = 561)
	Male (n = 256)	Female (n = 305)	
Hookworm	55 (21.5)	62 (20.3)	117 (20.9)
Strongyloides stercoralis	53 (20.7)	37 (12.1)	90 (16.0)
Trichuris trichiura	1 (0.4)	0	1 (0.2)
Ascaris lumbricoides	0	0	0
Mixed infection	10 (3.9)	21 (6.9)	31 (5.5)

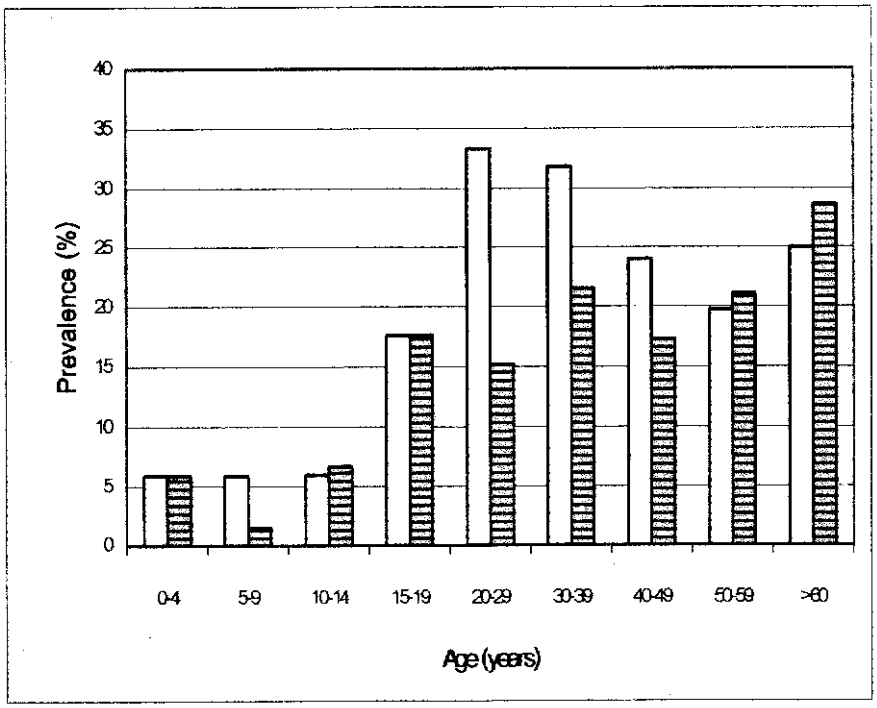

Figure 1 The comparison in prevalence of Hookworm ☐ and *Strongyloides stercolaris* ▤ among inhabitants classified by age.

Other factors such as having 1-4 people in family, having knowledge concerning the transmission of STH, the cleanliness of latrine and salary did not affect Hookworm and *Strongyloides stercoralis* infections as shown in table 3 ($p>0.05$). In this study the prevalence of *Ascaris lumbricoides* was not detectable and that of *Trichuris trichiura* was too low to analyse.

Table 3 The Statistic determination of interested variables in Hookworm and Strongyloides stercoralis infection.

Infection / Variables	Hookworm			*Strongyloides stercoralis*		
	Odds ratio	95% confidence interval	P-value	Odds ratio	95% confidence interval	P-value
Male	1.07	0.70-1.65	0.82	1.89	1.16-3.08	<0.05
Having 1-4 people in family	0.82	0.53-1.27	0.40	0.68	0.42-1.10	0.12
Having an agricultural occupation	3.15	1.95-5.13	<0.05	2.44	1.45-4.14	<0.05
Income (1,000 baht)	1.05	0.65-1.69	0.92	1.12	0.66-1.88	0.75
Having a minimum of a Bachelor's degree	0.30	0.09-0.93	<0.05	0.31	0.07-1.11	0.08
Having knowledge concerning the transmission of STH	1.13	0.69-1.85	0.68	0.92	0.52-1.62	0.87
Irregular defecating in latrine	1.84	1.02-3.34	<0.05	0.82	0.47-1.44	0.55
Having a latrine outside the house	1.66	1.01-2.76	<0.05	1.23	0.71-2.14	0.52
Good cleanness of latrine	1.09	0.71-1.70	0.75	1.02	0.62-1.66	0.97
Having a latrine at field	0.45	0.21-0.94	<0.05	1.20	0.62-2.28	0.67

Discussion

The moderately high overall prevalence of STH infection, especially Hookworm and *Strongyloides stercoralis* in this study was similar to those reported by Smarn Tesana and his coworkers in 1987, although anthelminthic drugs can rapidly reduce the prevalence and the intensity of helminths. This might be related to the fact that sources of the infective stage of the parasite are located near the inhabitants and so reinfection can occur continuously.

The present results demonstrated that Hookworm and *Strongyloides stercoralis* infectivity were much more common than *Ascaris lumbricoides* and *Trichuris trichiura*. Three particular aspects: the higher sensitivity to unfavorable environment (dryness and high temperature)[12, 13] and many common anthelminthic drugs available,[14] the larger size in human

body and the more simple life cycle of *Ascaris lumbricoides* and *Trichuris trichiura* result in the rather low prevalence of both parasites.

Within two different age groups, the school age group had lower prevalence of Hookworm and *Strongyloides stercoralis* than the working age group. This finding is similar to a previously published report.[15] The low prevalence may reflect the health care of the children including physical and laboratory examinations that are conducted annually in this community. Among the working age group, farmers and gardeners have a higher prevalence of STH, likely due to an increased exposure to the infective stage of STH.

Having a latrine at field could reduce the infection rate of Hookworm infection but not affect the prevalence of *Strongyloides stercoralis* infection. This could be explained by the fact that the *Strongyloides stercoralis* life cycle is more complex than that of Hookworm, based on its potential for autoinfection, multiplication within the host, and alternation between free-living and parasitic cycles. Furthermore, this finding may indicate that the sources of the infective stage of *Strongyloides stercoralis* are widespread, whereas Hookworm is found more frequently in the field. Therefore, environment pollution with STH should be further investigated in order to determine the sources and routes of infection and devise effective control strategy.

The data presented here suggests that improvements in sanitation for controlling STH infection such as the construction of public latrine at field should be implemented in this village with the cooperation of local health personnel, other governmental officers and inhabitants.

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