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Prevalence and risk factors of soil-transmitted helminth among minority indigenous community in Malaysia

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ABSTRACT

Soil-transmitted helminth (STH) infections occurs via fecal-oral route. WHO has reported there are up to 90% of children from poor communities with inadequate hygiene and sanitation prone to at least one STH infection. In Malaysia, the indigenous community (Orang Asli) is the predominant communities prone to STH infections. Hence, this study was aimed to determine the prevalence of STHs infections among Orang Asli in Kampong Donglai Baru, Semenyih, Selangor. Questionnaires surveys were conducted to gather information on the risk factor associated with the Orang Asli community following with stool samples were collected from the villagers. Basic parasitology method, floatation technique was carried out to determine the type and burden of STHs. Total sample obtained from salt-sugar floatation method were sixty seven (n=67), with 64 (95.5%) were positive for STH infection. The prevalence of *Trichuris trichiura* was 85.9% (n=55) while *Ascaris lumbricoides* was 93.8% (n=60). Results shown majority of the villagers have double infection (79.7%, n=51). Several risk factors were found significantly associated (p<0.05) with *T. trichiura* infection such as age factors, education level and frequency of hand washing. However, those risk factors were no significant associated with *A. lumbricoides* infection. The study showed a higher prevalence rate of STH infection predominantly by *Trichuris trichiura* and *Ascaris lumbricoides* within a small group of the Orang Asli community, hence further prevention method like administration of anthihelminthic drug is recommended.

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INTRODUCTION

Soil transmitted helminth (STH) infection which taints human health are transmitted through the fecal-oral route among the poor around the world (Paige *et al.*, 2017; Shumbej and Girum, 2019). The global prevalence of STH infections is approximately 2 billion people (Gordon *et al.*, 2017; Pasaribu *et al.*, 2019). It is caused by various species of parasitic worms like *Ascaris lumbricoides*, *Trichuris trichiura, Strongylodes stercoralis, Schistosomiasis* and hookworms such as *Necator*

americanus and Ancylostoma duodenale (Jourdan *et al.*, 2018; Workineh *et al.*, 2020).

Malaysia is considered as middle-income country in South-East Asia (Geik and Sidek, 2015). However, there is a minor group of people in this country known as *Orang Asli* whom has low household income and live in rural areas (Masron *et al.*, 2013). Studies conducted in recent years reported a high prevalence of STH infections, which ranges from 90% and up to 100% among *Orang Asli* communities in the rural and remote west Malaysia (Ngui *et al.*, 2015, 2011). Overall, *T. trichiura* is the most prevalent helminth in Malaysia (2.1% to 98.2%) followed by *A. lumbricoides (*4.6-86.7%) and hookworm is the least prevalent with 0-37.0% (Ahmed *et al.*, 2011). The associated risk factors for this infection were open defecation, not using footwear, poor hand hygiene and close contact with domestic animals (Ahmed *et al.*, 2011; Gall *et al.*, 2017; Ngui *et al.*, 2015).

Temuan tribe under Proto-Malay subtribe are classified as the second largest Orang Asli tribe in Peninsular Malaysia (Md-Zain *et al.*, 2017). The Orang Asli community in Hulu Semenyih, Selangor, Malaysia are predominantly Temuan tribe (Said *et al.*, 2012). Despite government effort to improvise their lifestyle, they are still prone to STH infection. Hence, this study was conducted in a Temuan tribe village in Malaysia to investigate the current prevalence of STH infection in this community. The findings of this study will benefit the government in implementing more effective preventive measures from 2020 onwards.

METHODOLOGY

Study location

A cross-sectional study was conducted in Kg. Orang Asli Donglai Baru, Hulu Semenyih district, Selangor state, Malaysia, from July to December 2019. The village is located (3°06'54.0"N 101°54'38.1"E) 37.9 km from Kuala Lumpur, the capital city of Malaysia. Most of the villagers are dependent on untreated hill water for their daily use. Besides, the Malaysian government has provided free concrete houses, pour-flush toilets, and electricity supply to most of the homes. The village has two different geographical locations in which some of the houses are on the hill and some nearby the main road of Sungai Lalang. The population is about 150 people predominantly from the Temuan tribe living in about 20 residential houses (Figure 1 is adapted from Google Maps).

Ethical approval

Approval for the present study was applied from the Department of Orang Asli Development (JAKOA). During the meeting with the villagers, the parents and the children have been informed which their participation is voluntary, and therefore they can withdraw from the study at any time. To improve compliance, the householders were explained about the importance of this study and the objective of the study prior to sample and data collection. Moreover, written consent also gathered from head of households.

Figure 1: Kampong Donglai Baru location

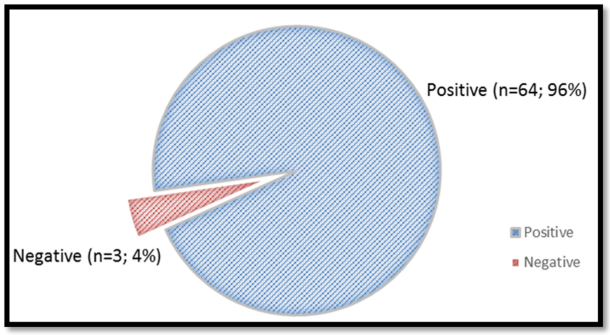

Figure 2: The overall prevalence of STH infections in Donglai Baru village.

Data collection

The study protocol was approved by Human Ethical Committee of UniKL [UNIKL REC /2020/003] and Department of Aboriginal Affairs of Malaysia (JAKOA) [ref: JAKOA/PP.30.032.Jld 46(95)], with prior consent from village leaders. Next, informed consent was obtained from each participants and parents of each children through verbal communication and voice recording.

Next, questionnaires were distributed to the head of each household and stool samples were collected. Random sampling technique was used in this study, therefore no restriction of age, gender, job and level of education to the respondents. The villagers were interviewed in the Malay language about their self-hygiene, such as handwashing habits, usage of footwear whenever doing activities outside the house, their daily activity place, and the frequency of

Table 1: The sociodemographic data of respondents in Donglai Baru village

Characteristics	Frequency (n)	Percentage (%)
Demographic factor		
Gender		
Male	33	49.3
Female	34	50.7
Age group		
Babies (0-2)	9	13.4
Children (3-16)	29	43.3
Young adults (17-30)	11	16.4
Middle-aged adults (31-45)	9	13.4
Old adults (Above 45)	9	13.4
Education		
Education	24	35.8
No education	43	64.2
Occupation (n=28)		
Working	17	60.7
Not working	11	39.3
Behavioural factor		
Availability of toilet		
Yes	53	79.1
No	14	20.9
Daily activity place		
Playing near housing area:	37	55.2
Outside housing areas:	30	44.8
Wearing footwear (n=58)		
Yes	50	86.2
No	8	13.8
Handwashing habit (n=58)		
Yes	57	98.3
No	1	1.7
Drinking treated water		
Yes	13	19.4
No	54	80.6

boiling drinking water. Pre-testing of the questionnaire was carried out for 30 people and all questionnaires were checked for completeness and accuracy.

Stool sampling and analysis

The samples were collected in 60 mL sterile specimen containers containing 70% ethanol solution as preservative (Nisha *et al.*, 2016). In helminths observation, stool samples were processed using floatation technique and McMaster was used for egg quantification (Nisha *et al.*, 2016).

Data analysis

Data analysis was performed using SPSS version 22. The demographic socioeconomic and behavioural characteristics were treated as categorical variables. The association of STHs prevalence was tested with the demographic socioeconomic and behavioural factors by using Pearson's Chi-square (X^2) test (p-value < 0.05).

RESULTS

Sociodemographic characteristics

A total of 67 participants voluntarily participated in this study. Out of them, 49.3% (n=33) were male, and 50.7% (n=34) were female respondents (Table 1). The mean age of the respondents participated was 19.67 years and majority of the participants were children age between 3-16 years old. Our survey indicated majority had no formal school

Table 2: The prevalence of STH infections in Donglai Baru village

Variables	Frequency of positive cases (n=64)	Prevalence (%)
STH species		
Trichuris trichiura	55	85.9
Ascaris lumbricoides	60	93.8
Hookworms	0	0.0
Types of infections		
Single infection	13	20.3
Double infection	51	79.7
Gender		
Male	32	50.0
Female	32	50.0
Age group		
Babies (0-2)	7	10.9
Children (3-16)	31	48.4
Young adults (17-30)	10	15.7
Middle-aged adults (31-45)	8	12.5
Old adults (Above 45)	8	12.5
Intensity of infection:		
I. *Trichuris trichiura*		
Light	20	45.3
Moderate	32	50.0
Heavy	3	4.7
II. *Ascaris lumbricoides*		
Light	40	68.8
Moderate	19	29.7
Heavy	1	1.6

Table 3: WHO classification on severity of infection for T. *trichiuraand* A. *lumbricoides* according to eggsper gram of faeces (e.p.g)

Infection	Light	Moderate	Heavy
Trichuris trichiura	1-999 epg	1,000-9,999 epg	>10,000 epg
Ascaris lumbricoides	1-4,999 epg	5,000-49,000 epg	>50,000 epg

education (64.2%; n=43) and only 60.7% (n=17) were employed.

For the availability of toilets, the majority of them had proper toilets (79.1%; n=53). We saw good respond for footwear usage and good hand hygiene practice, 86.2% (n=50) and 98.3% (n=57) respectively. However, only 19.4% of the respondent were drinking boiled water daily.

Prevalence of soil-transmitted helminth (STH) infections

Overall, there were two STH have been found in this village; namely; *Trichuris trichiura* and *Ascaris lumbricoides* Out of 67 participants, 64 (96%) were positive for at least one STHs been infected (Figure 2). The prevalence of *T. trichuria* and *A. lumbricoides* were 85.9% (n=55) and 93.8% (n=60) respectively. We found 13 participants with a single infection of STH (20.3%), 51 participants with double infection (79.7%), and there are no participants with triple infection been diagnosed (Table 2).

For *T. trichiura*, we found most of the villagers had light (45.3%; n=29) to moderate (50.0%; n=32) infections. However, the majority of the villagers had light infections of *A. lumbricoides* with 68.8% (n=44) of intensity. The intensity of STH infections were classified into light, moderate and heavy infection in Table 3, based on WHO guidelines (WHO, 2011).

The risk factor associated with STH infections

The risk factor associated with STH diseases con-

Table 4: The risk factor for soil-transmitted helminth (STH) infections among Orang Asli

Risk factors		Frequency (n=64; (%))		X^2	
Demographic		*T. trichiura*	*A. lumbricoides*	*T. trichiura*	*A. lumbricoides*
Gender	Male	29 (45.3)	29 (45.3)	0.474	0.613
	Female	26 (40.6)	31 (48.4)		
Age	0-2	5 (7.8)	6 (9.4)	0.273	0.634
	3-16	28 (43.8)	30 (46.9)		
	17-30	7 (10.9)	9 (14.1)		
	31-45	7 (10.9)	7 (10.9)		
	46 and above	8 (12.5)	8 (12.5)		
Education	Education	20 (31.3)	21 (32.8)	0.707	1.000
	No education	35 (54.7)	39 (60.9)		
Occupation (n=27)	Working	14 (51.9)	15 (55.6)	1.000	1.000
	Not working	9 (33.3)	10 (37.0)		
Behavioural factors				***T. trichiura***	***A. lumbricoides***
Availability of toilet	Yes	42 (65.6)	48 (75.0)	0.670	0.206
	No	13 (20.3)	12 (18.8)		
Daily activity place	Playing near housing area	28 (43.8)	33 (51.6)	0.483	0.333
	Outside housing areas	27 (42.2)	27 (42.2)		
Wearing footwear (n=57)	Yes	42 (73.7)	46 (80.7)	0.577	1.000
	No	8 (14.0)	8 (14.0)		
Handwashing habit (n=57)	Yes	49 (86.0)	53 (93.0)	1.000	1.000
	No	1 (1.8)	1 (1.8)		
Drinking treated water	Yes	12 (18.8)	12 (18.8)	0.672	1.000
	No	43 (67.2)	48 (75.0)		

cerning socio-demographic factors among Orang Asli were examined using univariate analysis. Pearsons' Chi-square test was used to test the association of demographic and behavioural factors with STH infections (*T. trichiura* and *A. lumbricoides*). For *T. trichiura*, we found age, education, and handwashing habit were significantly associated with 0.005, 0.028, and 0.001 respectively. Meanwhile, there were no significant association between *A. lumbricoides* and all risk factors (*p-value< 0.05*). Table 4 demonstrates the association of these factors with STH infections.

DISCUSSION

Soil-transmitted helminth (STH) infection (especially *T. trichiura* and *A. lumbricoides*) is existing among Orang Asli community. The cases on morbidity of STH infections among this community has remained over the past 100 years despite many improvement efforts from the Malaysian government (Nasr *et al.*, 2013). Previous reports indicated lack of proper personnel hygiene practice like using toilets for defecations, poor hand hygiene and not taking deworming drugs contributed to the continuous STH occurrence among the Orang Asli. Additionally, the anti-helminthic drug treated villagers like Orang Asli are prone to be re-infected with STH infection due to their contaminated environment and poor hygiene practice (Nasr *et al.*, 2020)

The prevalence of STH infections in this study was 96% (n=64). This rate of infection is higher than previous study from Ethiopia with 70.3% cases been reported (Tekalign *et al.*, 2019). In this study, the prevalence of *T. trichiura* (85.9%) and *A. lumbricoides* infections (93.8%) were contrary to the previous findings in Ethiopia, with 66.8% (n=252) infection of *T. trichiura,* which higher than *A. lumbricoides* infection 16.4% (n=62) (Tekalign *et al.*, 2019). However, the sample size were higher in Ethiopia. In this study, hookworms were not detected, as this may be due to the nature of the soil in the study location which is non-loamy soil where the hookworm unable to survive (Nisha *et al.*, 2016).

We found double infection was higher than the single infection with 79.7% (n=51) and 20.3% (n=13) respectively. This findings is identical to a report

in 2013, which majority of respondents had double infection of *A. lumbricoides* and *T.trichiura* with 62.7% (Debalke *et al.*, 2013). For the egg intensity with reference to WHO guidelines, we found light infection was 45.3% (n=29), and moderate infection (50.0%; n=32) *T. trichiura* and light infections (68.8%; n=44) for *A. lumbricoides.* These were contrary to the previous study in 2019, which the Orang Asli had moderate to heavy infection with 65.6% and 53.6% among children and adults respectively (Muslim *et al.*, 2019).

Table 4 shows the risk factors for STH infections among Orang Asli. In this study, we found all the sociodemographic as well as behaviour risk factors were not associated (p<0.05) with STH infections (*T. trichiura* and *A. lumbricoides*). This study is quite similar to previous study (univariate analysis) in Malaysia, in which gender (p= 0.31), occupation (p=0.48), handwashing habit (before eating (p=0.97); after defecation (p=0.52); and after contact with soil (p=0.12)) were not significant associated with STH infections (Muslim *et al.*, 2019). In contrast, Workineh and colleagues reported risk factors like educational grade (level 1-4) and no handwashing habit before eating were significantly associated with STH infections (*T. trichiura* and *A. lumbricoides*) with p=0.03 and p=0.006 respectively (Workineh *et al.*, 2020). In addition, Yang et al., also reported usage of river water was significantly associated to *Ascaris lumbricoides* (Yang *et al.*, 2018).

We found hand hygiene was not significantly associated to *T. trichuria* infection. However, as *T. trichiura* infection is spread via fecal oral route, the fertile eggs deposited in nails of the Orang Asli could lead to this infection. Hence, good hand hygiene using provision of soaps will aid in reducing this infection. A contrary observation was found in a study which investigated the relatedness between children and mothers (caregiver) with poor hand hygiene habit for STH infection (Novianty *et al.*, 2018). In contrary with our results, Studies detected significant associations between the gender, occupation, availability of toilet, wearing footwear, handwashing habit and drinking treated water for STH infections (Nasr *et al.*, 2013; Strunz *et al.*, 2014; Worrell *et al.*, 2016)

Study limitation

This study has a few potential limitations. First the sample size was small with only 67 participants. Majority were reluctant to participate due to cultural belief and unwillingness to give stool samples for observation. Next, we only use a single method which uses floatation fluids for eggs observation and egg burden estimation. This could reduce our chances of observing other parasite with different specific gravity. The fact that the stool were given in limited amount, it was impossible to try various technique to detect various other helminths.

CONCLUSIONS

In the nutshell, the study showed a higher prevalence rate of STH infection predominantly by *Trichuris trichiura* and *Ascaris lumbricoides* within a small group of the Orang Asli community. Common basic practices like lack of proper hand washing habit and usage of toilet were significantly related to this infection. We strongly suggest health education campaign and routine chemotherapy to aid in the reduction of STH infection in this Orang Asli villagers.

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Conflict of interest

The authors declare that they have no conflict of interest for this study

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