ORIGINAL ARTICLE

Prevalence and Predictors of Intestinal Worm Infections Among Semai Aboriginal Tribe School Children in Tapah, Malaysia

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ABSTRACT

Introduction: Worm infection is one of the major global public health problems especially among rural communities. **Objectives:** to determine the prevalence of intestinal worm infection and factors associated among Semai Aboriginal children aged between 6 to 13 years in Tapah, Malaysia. **Methods:** A cross-sectional study design was used in this study. The estimated sample size was 508. Data was collected using a validated pretested questionnaire. Faecal samples were also examined. Data was analysed using SPSS version 22. **Results:** The response rate was 80.9%. The overall mean age of the 411 respondents was 10.1 years(95% CI = 9.89, 10.22). Majority (71.5%) were poor. Prevalence of intestinal worm infections was 60.8% and 57.2% had multiple infections. The multiple logistic regression analysis showed that those with poor hygiene practices were 2.18 times the odds of worm infection when compared with children with good hygiene practices (95% CI = 1.4, 3.4). Similarly, poor attitudes towards prevention of worm infection increased the odds of having worm infection by 1.62 times among Orang Asli children. Children living without toilets had 2.45 times higher odds as compared with those who had proper toilets. Absence of river near by these areas where there is no safe water supply also increases the risk of worm infection among children by 1.84 times among Orang Asli children. **Conclusions:** the prevalence of worm infection is still very high among rural Aboriginal community. Current control measures should be reassessed to enable introduction of effective measures to reduce the worm infection among Orang Asli children.

Keywords: Worm infection, Intensity, KatoKatz, prevalence, Semai aboriginal children

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INTRODUCTION

Worm infections are among the most common infections worldwide and affect the poorest and most deprived communities. Approximately two billion people (24% of the world's population) are infected with worm infections worldwide (1). About 1.5 billion people in developing regions of sub-Sahara Africa, Asia and Americas are infected with intense worm infection that aggravates poverty, productivity, and socio-economic development (2). The highest prevalence of worm infection is found among children between five to twelve years and usually those with deprived living resources (3). The health impacts of worm infection include abdominal pain, cholangitis, obstructive jaundice, acute pancreatitis and hepatic abscess (4-5), physical and mental impairment (6), central nervous system and ocular disorders and epilepsy (7-8), and death in more extreme cases (9). Despite Malaysia's economy being one of the most competitive in Asia, intestinal worm infection is still common. In Malaysia, the prevalence of worm infection is higher among the poor, staying in the rural area, with poor socioeconomic, environmental and behavioural factors (10), poor knowledge and attitude about worm infection (11). The objective of the study was to determine the prevalence and predictors of intestinal worm infection among Semai Aboriginal school children aged between 6 to 13 years in Tapah, Malaysia.

MATERIALS AND METHODS

Study location, study design, sampling:
This analytical cross-sectional study was carried out among the orang asli population living between 5th

mile to 17th mile Jalan Pahang Tapah Batang Padang District, Perak, Malaysia. There are 40 orang asli villages located in this area. All the Orang Asli in these belong to Semai Tribe. There are two primary schools built by the Government to cater for children aged between 6 to 13 years in this area. These two schools are located at seventh and fourteenth mile from Tapah town, the capital of Batang Padang district. The estimated sample size was 508 using the formula for hypothesis testing for two group comparison. Sampling with probability proportionate to size was used for the selection of school children from each school. Children whose parents did not give written consent were excluded from the study.

Data collection

A pre-tested standardized questionnaire was used to obtain data on socio-demographic characteristics, environment and sanitation, knowledge, attitude and hygiene practices related to worm infection. Faecal samples were collected using wide mouth screw cap clean containers and transported in a hazard safety box to the Universiti Putra Malaysia parasitology laboratory for examination. Formol ether concentration technique was used to examine for the presence of worm eggs in the faecal samples. Kato-Katz technique was used to examine for egg quantification as a measure of worm burden, and reported as eggs per gram of faeces (epg). The intensity of infection was categorized as heavy, moderate or light.

Data analysis

Data was analysed using Software Package for Social Science, SPSS 22.0. Descriptive characteristics were obtained as mean, frequency and percentages. Intestinal worm infection was presented as frequency and percentage. Chi square test was used to test association between the categorical socio-demographic variables and intestinal worm infection. Independent t test was used to compare two means while one way ANOVA was used to compare means of more than 2 groups. Continuous variables were presented as means with 95% Confidence interval (CI). Univariate logistic regression was used to determine the crude odd ratio and variables with *p* value < 0.25 were entered into the multivariate logistic regression model to determine significant predictors to intestinal worm infections in the Orang Asli children. The result was interpreted based on the obtained adjusted odds ratio and p value. A p value less than 0.05 was considered statistically significant.

Ethical considerations

Approval was obtained from the Universiti Putra Malaysia Ethics Committee for Research involving Human Subjects (Reference No: UPM/TNCPI/RMC/1.4.18.1 (JKEUPM)/ F1, dated 21st February, 2014). Permission was also obtained from the Ministry of Education Malaysia; State Education Department, District Education Department and the Head of Schools. Written consents of both the respondents and their parents were obtained.

RESULTS

Response rate

Out of the 508 respondents, 411 children (200 males and 211 females) participated in the study giving a response rate of 80.9%.

Socio-demographic characteristics of respondents

The mean age of the 411 respondents was 10.1 years (95% CI = 9.89, 10.22) and ranged from 6 – 13 years. There was no significant difference between the mean age of the male and female (t= 5.68, p = 0.570). Majority (51.3%) were female. None of the parents had a tertiary education. Majority (94%) of the mothers were full time housewives. Majority of the fathers were self-employed (51.1%) and 26.8% were jobless. Majority (71.5%) were poor with a total family monthly income of less than 500.00 Ringgit Malaysia (RM). The mean total family monthly income was RM 429.00 (95% CI. RM 382 - 475). Majority of the mothers (94.2%) were full time house wives. Only 39.9% of the families had sanitary latrine and 28% of them had no toilets at all.

Prevalence of worm infection by intensity of infection

Table 1 shows prevalence of worm infection by intensity of infection. The overall prevalence of worm infection was 60.8%.and 57.2% had multiple infections. The prevalence of trichuriasis, ascariasis, taeniasis and hookworm infection was 53.8%, 34.3%, 9.5% and 4.1% respectively. The results show that moderate and high intensity infections were seen only in ascariasis and trichuriasis infection.

Prevalence and association between intestinal worm infection and socio-demographics, environmental and behavioural factors

Tables 2-4 show that prevalence of intestinal worm infection was associated with age, presence of river (χ^2 = 9.411; p = 0.002), toilet system (χ^2 = 8.058; p = 0.005), presence of electricity (χ^2 = 8.368; p = 0.005), and presence of dogs (χ^2 = 4.738; p = 0.030). Prevalence of intestinal worm infection was also associated with attitude (χ^2 = 11.585; p = 0.001) and hygiene practices (χ^2 = 21.275; p = 0.001), There was no significant association between intestinal worm infection and gender (χ^2 = 3.57.505; p = 0.059), father's education (χ^2 = 0.377; p = 0.828), mother's education (χ^2 = .030; p = 0.864), father's occupation (χ^2 = .114; p = 0.736), mother's occupation (χ^2 = 3.57.505; p = 0.059), total family income (t = 0.424; df= 409, p = 0.672) and knowledge (χ^2 = .505; p = 0.477).

Predictor for worm infection

Tables 5 and 6 show the results of univariate and multivariate logistic regression analysis of factors associated with worm infection among Orang Asli children. The multiple logistic regression model retained five factors associated with worm infection. Those with poor hygiene practices were 2.18 times the odds

Table 1: Prevalence of ascariasis, trichuriasis, hookworm infection by intensity of infection **(n = 411)**

Type of infections / Intensity of infections	Number N=411 (%)
Overall (Any type)	250 (60.8)
Multiple type of infection	143 (57.2)
Ascariasis	
Low	114 (80.9)
Moderate	27 (19.1
High	0 (0.0)
Trichuriasis	
Low intensity	180 (81.5)
Moderate	35 (15.8)
High	6 (2.7)
Mean (epg)	1070
Total with Trichuriasis	221 (53.8)
No Trichuriasis worm infection	190 (46.2)
Hookworm	
Low intensity	17 (100.0)
Moderate	0 (0.0)
High	0 (0.0)
Mean (epg)	28.4
Total with Ascariasis	17 (4.1)
No Ascariasis worm infection	394 (95.9)

Table 2: Prevalence and association between socio-demographics and intestinal worm infection (n = 411)

	Worm infection			
Variables	Present (%)	Absent (%)	χ^2	*P*
Age group (years)				
6 -	4 (30.8)	9 (69.2)	15.03	0.020*
7-	24 (47.1)	27 (52.9)		
8-	42 (70.1)	18 (30.0)		
9-	40 (65.6)	21 (34.4)		
10-	51 (57.3)	38 (42.7)		
11-	37 (58.7)	26 (41.3)		
12-	52 (70.3)	22 (29.7)		
Total	250 (60.8)	161 (39.2)		
Gender				
Male	131(65.5)	69(34.5)	3.570	0.059
Female	119(56.9)	92(43.6)		
Father's Education				
No formal Education	22(56.4)	17 (43.7)	0.377	0.828
Primary	138 (61.6)	86(38.4)		
Secondary	90(60.8)	58(39.2)		
Mother's Education				
≤ Primary	186(60.6)	121(39.4)	0.030	0.864
≥ Secondary	64(61.5)	40(38.5)		
Father's occupation				
Not working	69(62.2)	42(37.8)	0.114	0.736
Working	181(60.3)	119(39.7)		
Mother's occupation				
Not working	236(61.0)	151(39.0)	.067	0.796
Working	14(58.3)	10(41.7)		
Mean total family monthly income (RM)	420.8	441.5	t = 0.424;	0.672

χ^2 = chi square value, Significance level p <0 .05

Table 3: Prevalence and association between environmental factors and intestinal worm infection (n = 411)

	Worm infection			
Variables	Present (%)	Absent (%)	χ^2	*P*
Water source for drinking				
Unsafe	16(66.7)	8(33.3)	0.365	0.547
Safe	234(60.5)	153(39.5)		
Water source for cooking				
Unsafe	14(66.7)	7(33.3)	0.317	0.575
Safe	236(60.5)	154(39.5)		
Water source for other use				
Unsafe	14(70.0)	6(30.0)	0.742	0.392
Safe	236(60.4)	155(39.6)		
Presence of river				
No	90(72.0)	35(28.0)	9.411	0.002*
Yes	160(55.9)	126(44.1)		
Toilet system				
Unsafe	164(66.4)	83(33.6)	8.058	0.005*
Safe	86(52.4)	78(47.6)		
Electricity supply				
No	52(76.5)	16(23.5)	8.368	0.005*
Yes	198(57.7)	145(42.3)		
Presence of cat				
No	97(59.9)	65(40.1)	0.101	0.750
Yes	153(61.4)	96(38.6)		
Presence of dogs				
No	72(53.3)	63(46.7)	4.738	0.030*
Yes	178(64.5)	98(35.3)		
Waste disposal system				
Unsafe	248(60.8)	160(39.2)	0 .043	0.836
Safe	2(66.7)	1(33.3)		

χ^2 = chi square value, Significance level p <0 .05

Table 4: Prevalence and association between knowledge, attitudes and practices and intestinal worm infection (n = 411)

Variables	Worm infection		χ^2	P
	Present (%)	Absent (%)		
Knowledge				
Poor	144(62.3)	87(37.3)	0.505	0.477
Good	106(58.9)	74(41.1)		
Attitude				
Poor	115(71.0)	47(29.0)	11.585	0.001*
Good	135(54.2)	114(45.8)		
Hygiene practices				
Poor	124(74.3)	43(25.7)	21.275	0.001*
Good	126(51.6)	118(48.4)		

χ^2 = chi square value, * Significance level p < 0.05

of worm infection when compared with children with good hygiene practices (95% CI = 1.4, 3.4). Similarly, poor attitudes towards prevention of worm infection increased the odds of having worm infection by 1.62 times among Orang Asli children. Children living without toilets had 2.45 times higher odds as compared with those who had proper toilets. Absence of river near by these areas where there is no safe water supply also increases the risk of worm infection among children by 1.84 times among Orang Asli children.

Table 5: Simple logistic regression analysis of factors associated with worm infection among Orang Asli children

Factors	B coefficient	Standard error	OR	95% CI	*P* value
Gender					
Male			1.00		
Female	0.321	0.224	1.38	0.9-2.1	0.152*
Age group					
12-12.9			1.00		0.075*
6-6.9	-1.541	0.700	0.21	0.05-0.8	0.028
7-7.9	-0.827	0.414	0.43	0.2-1.0	0.041
8-8.9	0.039	0.411	1.04	0.5-2.3	0.924
9-9.9	-0.087	0.401	0.92	0.4-2.0	0.827
10-10.9	-0.416	0.363	0.66	0.3-1.3	0.252
11-11.9	0.671	0.403	0.51	0.2-1.1	0.096
River Present					
Present			1.00		
Absent	0.612	0.258	1.84	1.1-3.0	0.018*
Presence of Dog					
Present			1.00		
Absent	-0.125	0.239	0.88	0.6-1.4	0.601
Type of toilet					
Pour flush			1.00		0.009*
Pit Latrine/others	0.218	0.260	1.24	0.7-2.1	0.402
No toilet	0.786	0.290	2.41	1.4-4.2	0.020*
Hygiene practice					
Good			1.00		0.002*
Poor	0.759	0.240	2.14	1.3-3.4	
Attitude					
Good			1.00		0.041*
Poor	0.484	0.236	1.62	1.0-2.6	
Electricity Use					
Use			1.00		0.121*
None	0.479	0.309	1.62	0.9-3.0	

*Significance level $p < 0.25$, OR= Odd ratio.

DISCUSSION

The Government of Malaysia has been continuously carrying out socio-economic development program in order to improve the economy and living conditions since 1970's. The Government Transformation Programme (GTP) was introduced by the Prime Minister in April 2009 and is led by him. GTP has become the overall engine of change. The objective of GTP is two-fold –to transform the Government to be more effective in its delivery of services and accountable for outcomes that matter most to the people; and to move Malaysia forward to become an advanced, united, and just society with high standards of living for all. This is in line with the national mission of achieving Vision 2020 for Malaysia to become a fully developed nation. In developing the NTP, the Government remained focused on the allocation of resources, and formulated targets and quantified outcomes for economic growth based on social aspects such as quality of life, cost of living, the safety and security of the people and promoting the values critical for the achievement of Government goals. In spite of the Government efforts and achievements, reaching a Gross Net Income per capita of RM36, 397 (US$ 11,120) in 2015, some sections of the society still have burden of worm infections. This study provides insight into an important issue and unsolved problem of worm infections among the aboriginal school children. The insight will be useful to Ministry of Health Malaysia and those who make long-term organizational decisions with regards the Health and Welfare of these people. The insight of the problem stimulates new, important questions what has been done and what further action needs to be done.

Our result showed majority (60.8%) of the Semai tribe school children in Tapah were infected with at least a species of intestinal worm and 57.2% had multiple

Table 6: Multivariate logistic regression analysis of factors associated with worm infection among Orang Asli children

Factors	B coefficient	Standard error	aOR	95% CI	*P* value
Gender					
Male			1.00		
Female	0.320	0.224	1.38	0.9-2.1	0.153
Age group					
12-12.9			1.00		0.058
6-6.9	-1.569	0.695	0.21	0.05-0.8	0.024
7-7.9	-0.876	0.411	0.42	0.2-1.0	0.033
8-8.9	0.023	0.410	1.02	0.5-2.3	0.955
9-9.9	-0.100	0.400	0.91	0.4-2.0	0.802
10-10.9	-0.445	0.359	0.64	0.3-1.3	0.215
11-11.9	0.700	0.399	0.50	0.2-1.1	0.080
River Present					
Present			1.00		
Absent	0.608	0.258	1.84	1.1-3.0	0.018*
Type of toilet					
Pour flush			1.00		0.007*
Pit Latrine/others	0.212	0.259	1.24	0.7-2.1	0.413
No toilet	0.895	0.288	2.45	1.4-4.3	0.02
Hygiene practice					
Good			1.00		
Poor	0.781	0.236	2.18	1.4-3.4	0.001*
Attitude					
Good			1.00		
Poor	0.484	0.236	1.62	1.0-2.6	0.040*
Electricity supply					
Use			1.00		
None	0.479	0.309	1.61	0.9-3.0	0.121

* Significant at p<0.05, aOR - adjusted Odds Ratio

infections. This is alarming, as previous studies in Malaysia have demonstrated similar high prevalence among orang asli population (11-12). This high prevalence rate among this group explains their life-style and socio-economic status, but also questions the effectiveness of the control and preventive measures put in place for the reduction of the infection among this group (13).

The prevalence and intensity of worm infection may vary by age, gender, ethnicity, socio-economic background, and lifestyle and daily practices. It also varies between countries and within the country. Our study demonstrated higher prevalence among males (65.5%) than females (56.4%) as reported in Ethiopia (3); India (14); Nepal (15). However, a greater prevalence among females than males have been reported in Cuba (16) and Pakistan (17). This variation could be due to environmental, cultural and socio-economic factors and also health and hygiene practices of the population under study. In this case, the higher prevalence seen among males was as a result of better hygiene practices among the female school children which were also observed during our study.

In our study, the prevalence of *T. trichura* was most common (53.8%) followed by *A. lumbricoides* (34.3%) and hookworm infection (4.1%). This triad trend of prevalence is commonly reported in Malaysia (10, 18) unlike in other countries such as Pakistan (17), Nepal (19) and Cuba (16) where *A. lumbricoides* was most prevalent. The prevalence of trichurasis in Malaysia as opposed to other part of Asia has been blamed on low susceptibility of the worms to anthelminthic drugs and as such, recommendation of a 3-day course of 400 mg Albendazole has been made which has proven success in the control of trichurasis in Malaysia (12). Our result showed that the prevalence of hookworm infection is low among the orang asli school children. This can be contributed to the provision of free school uniform (including shoes) to orang asli school children by the Government. This insight is useful information to the relevant agencies that their program is successful and to expand further.

Our findings showed that only 43.8% of the parents had good knowledge of worm infection in terms of what human worms are, their names, mode of transmission, signs and symptoms and prevention of worm infections.

Similar results have been reported in Zimbabwe where only 32% of the rural dwellers had good knowledge about the infection (20). This shows that comprehensive health education is still needed among the group in other to have full understanding of the prevention of worm infection. Our study showed that about 40% of the Orang Asli parents had poor attitude towards worm infection and that presence of poor general hygiene practices, poor attitudes, and no/poor toilet system and were significant predictors for worm infection among these group. Studies in Malaysia (21) and Zimbabwe (20) have reported that people's poor attitude was based on poverty, socio-economic status and belief.

CONCLUSIONS

In conclusion, the prevalence of worm infection is high among Orang Asli children population in Tapah, Perak. There is a need for reassessment of current worm control measure with emphasis on health education, de-worming program and improvement in basic environmental infrastructure to reduce the infection among the Orang Asli children.

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