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LIST OF PUBLICATIONS AND PRESENTATIONS

A. Publications during candidature, directly arising from this thesis

1. **Al-Delaimy AK**, Al-Mekhlafi HM, Nasr NA, Sady H, Atroosh WM, Nashiry M, Anuar TS, Mokhtar N, Lim YAL, Mahmud R. Epidemiology of intestinal polyparasitism among Orang Asli schoolchildren in rural Malaysia. *PLOS Neglected Tropical Diseases* 2014; 8(8): e3074.
2. **Al-Delaimy AK**, Al-Mekhlafi HM, Nasr NA, Sady H, Atroosh WM, Lim YAL, Mahmud R. **Developing and evaluating health education learning package (HELP) to control soil-transmitted helminth infections among Orang Asli children in Malaysia.** *Parasites and Vectors* 2014; 7:416.
3. **Al-Delaimy AK**, Al-Mekhlafi HM, Nasr NA, Sady H, Atroosh WM, Lim YAL, Mahmud R. **A rapid and high reinfection of soil-transmitted helminth infections among Orang Asli children in rural Malaysia.** *Parasites and Vectors* 2014; **UNDER REVIEW**.
4. **Al-Delaimy AK**, Al-Mekhlafi HM, Nasr NA, Lim YA, Mahmud R. Epidemiology of soil-transmitted helminths infections among aboriginal schoolchildren in rural Malaysia. **(Abstract)**. *American Journal of Tropical Medicine and Hygiene* 2013; 98(5 Suppl): 755.

B. Publication during candidature, but not directly arising from this thesis

5. Al-Mekhlafi HM, Al-Zabedi EM, Al-Maktari MT, Atroosh WM, **Al-Delaimy AK**, Mokhtar N, Salam AA, Abdullah WA, Jani R, Surin J. Effects of vitamin A supplementation on iron status indices and iron deficiency anaemia: A randomized controlled trial. *Nutrients* 2014; 6: 190-206.
6. Al-Mekhlafi HM, Sady H, Mahdy MA, Nasr NA, **Al-Delaimy AK**, Surin J. An unceasing problem: prevalence and risk factors of schistosomiasis among children in Yemen **(Abstract)**. *American Journal of Tropical Medicine and Hygiene* 2013; 98(5 Suppl): 897.

C. Conference presentations made during the candidature period **(presenter)**

1. **Al-Mekhlafi HM**, **Al-Delaimy AK**, Lim YAL, Mahmud R. Pattern of soil-transmitted helminth re-infections among Orang Asli schoolchildren in Malaysia. The British Society for Parasitology Spring Meeting 2014, Cambridge, UK, 6-9 April 2014.
2. **Ahmed K. Al-Delaimy**, Al-Mekhlafi HM, Lim YAL, Mahmud R. The impact of health education in controlling soil-transmitted helminthiasis. 1st International Conference on Tropical Medicine and Infectious Diseases, Royal College of Medicine, Perak, 4-7 Dec 2012.
3. **Ahmed K. Al-Delaimy**, Ahmed A, Al-Mekhlafi HM, Lim YAL, Mahmud R. Soil-transmitted helminth infections among schoolchildren in Orang Asli and Malay communities in rural Malaysia., JITMM 2012 Mahidol University, Bangkok, Thailand, 12-14 Dec 2012.

Epidemiology of Intestinal Polyparasitism among Orang Asli School Children in Rural Malaysia



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Abstract

Background: This cross-sectional study aimed to investigate the current prevalence and risk factors associated with intestinal polyparasitism (the concurrent infection with multiple intestinal parasite species) among Orang Asli school children in the Lipis district of Pahang state, Malaysia.

Methods/Principal findings: Fecal samples were collected from 498 school children (50.6% boys and 49.4% girls), and examined by using direct smear, formalin-ether sedimentation, trichrome stain, modified Ziehl Neelsen stain, Kato-Katz, and Harada Mori techniques. Demographic, socioeconomic, environmental, and personal hygiene information were collected by using a pre-tested questionnaire. Overall, 98.4% of the children were found to be infected by at least one parasite species. Of these, 71.4% had polyparasitism. The overall prevalence of *Trichuris trichiura*, *Ascaris lumbricoides*, hookworm, *Giardia duodenalis*, *Entamoeba* spp., and *Cryptosporidium* spp. infections were 95.6%, 47.8%, 28.3%, 28.3%, 14.1% and 5.2%, respectively. Univariate and multivariate analyses showed that using an unsafe water supply as a source for drinking water, presence of other family members infected with intestinal parasitic infections (IPI), not washing vegetables before consumption, absence of a toilet in the house, not wearing shoes when outside, not cutting nails periodically, and not washing hands before eating were significant risk factors associated with intestinal polyparasitism among these children.

Conclusions/Significance: Intestinal polyparasitism is highly prevalent among children in the peninsular Malaysian Aboriginal communities. Hence, effective and sustainable control measures, including school-based periodic chemotherapy, providing adequate health education focused on good personal hygiene practices and proper sanitation, as well as safe drinking water supply should be implemented to reduce the prevalence and consequences of these infections in this population.

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Introduction

Intestinal parasitic infections (IPI) are still public health problems in many communities, particularly among children in rural areas of developing countries. It is estimated that more than 2 billion people worldwide are infected with IPI and more than half of the world's population are at risk of infection [1,2]. These infections are caused by helminth parasites such as soil-transmitted helminths (*Ascaris lumbricoides*, *Trichuris trichiura*, *Strongyloides stercoralis*, and hookworm), *Taenia* spp. and *Hymenolepis nana* or by protozoa such as *Entamoeba histolytica*, *Giardia duodenalis*, and *Cryptosporidium* spp.

IPI are associated with high morbidity particularly among young children and women of childbearing age, and have been termed as 'the cancers of developing nations' by Egger et al.

[3]. IPI can occur in silence as chronic infections and infected individuals are either asymptomatic or suffering from mild diseases. However, acute and severe IPI, especially with pathogenic *Entamoeba* and *Giardia*, may cause fatal diarrhea especially among children and both are commonly associated with travellers' diarrhea [4,5]. Moreover, *Entamoeba* can cause invasive intestinal infection or disseminate to the liver (and rarely to the lung and the brain) causing amebic liver abscess with about 100,000 deaths annually, making amebiasis the second leading cause of death from protozoal diseases, after malaria [6,7]. On the other hand, opportunistic IPI such as *Cryptosporidium*, *Isospora belli*, Microsporidia, and *Strongyloides* infections are commonly reported among immunocompromised individuals with significant morbidity and mortality [8,9].



RESEARCH

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Developing and evaluating health education learning package (HELP) to control soil-transmitted helminth infections among Orang Asli children in Malaysia

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Abstract

Background: This study was carried out to develop a health education learning package (HELP) about soil-transmitted helminth (STH) infections, and to evaluate what impact such a package could have in terms of reducing the incidence and intensity of STH infections among Orang Asli schoolchildren in Pahang, Malaysia.

Methods: To identify the key risk factors of STH in Orang Asli communities, we applied an extensive mixed methods approach which involved an intensive literature review, as well as community-based discussions with children, their parents, teachers and health personnel, whilst also placing the children under direct observation. To evaluate the package, 317 children from two schools in Lipis, Pahang were screened for STH infections, treated by a 3-day course of albendazole and then followed up over the next 6 months. The knowledge of teachers, parents and children towards STH infections were assessed at baseline and after 3 months.

Results: The developed package consists of a half day workshop for teachers, a teacher's guide book to STH infections, posters, a comic book, a music video, a puppet show, drawing activities and an aid kit. The package was well-received with effective contributions being made by teachers, children and their parents. The incidence rates of hookworm infection at different assessment points were significantly lower among children in the intervention school compared to those in the control school. Similarly, the intensity of trichuriasis, ascariasis and hookworm infections were found to be significantly lower among children in the HELP group compared to those in the control group ($P < 0.05$). Moreover, the package significantly improved the knowledge, attitude and practices (KAP) of Orang Asli people and the knowledge of teachers towards STH infections.

Conclusion: A school-based health education learning package (HELP) was developed which displayed a significant impact in terms of reducing the intensity of all three main STH infections, as well as in reducing the prevalence of hookworm infections. Moreover, the knowledge levels of both teachers and the Orang Asli population regarding STH was significantly improved, a fact which greatly helped in attracting community participation and thus raising the general level of awareness regarding these forms of infections.

Keywords: Soil-transmitted helminth, Health education learning package, Neglected tropical diseases, Reinfection, Orang Asli, Children, Malaysia

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