

# Prevalence and Risk Factors of Intestinal Parasitism in Rural and Remote West Malaysia

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## Abstract

**Background:** Intestinal parasitic infections (IPIs) have a worldwide distribution and have been identified as one of the most significant causes of illnesses and diseases among the disadvantaged population. In Malaysia, IPIs still persist in some rural areas, and this study was conducted to determine the current epidemiological status and to identify risk factors associated with IPIs among communities residing in rural and remote areas of West Malaysia.

**Methods/Findings:** A total of 716 participants from 8 villages were involved, comprising those from 1 to 83 years old, 550 (76.8%) participants aged  $\leq 12$  years and 166 (23.2%) aged  $\geq 13$  years, and 304 (42.5%) male and 412 (57.5%) female. The overall prevalence of IPIs was high (73.2%). Soil-transmitted helminth (STH) infections (73.2%) were significantly more common compared to protozoa infections (21.4%) ( $p < 0.001$ ). The prevalence of IPIs showed an age dependency relationship, with significantly higher rates observed among those aged  $\leq 12$  years. Multivariate analysis demonstrated that participants aged  $\leq 12$  years (OR = 2.23; 95% CI = 1.45–3.45), low household income (OR = 4.93; 95% CI = 3.15–7.73), using untreated water supply (OR = 2.08; 95% CI = 1.36–3.21), and indiscriminate defecation (OR = 5.01; 95% CI = 3.30–7.62) were identified as significant predictors of IPIs among these communities.

**Conclusion:** Essentially, these findings highlighted that IPIs are highly prevalent among the poor rural communities in West Malaysia. Poverty and low socioeconomic with poor environmental sanitation were indicated as important predictors of IPIs. Effective poverty reduction programmes, promotion of deworming, and mass campaigns to heighten awareness on health and hygiene are urgently needed to reduce IPIs.

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## Introduction

Globally, the neglected intestinal parasitic infections (IPIs) such as soil-transmitted helminth (STH) and protozoa infections have been recognized as one of the most significant causes of illnesses and diseases especially among disadvantaged communities. With an average prevalence rate of 50% in developed world, and almost 95% in developing countries, it is estimated that IPIs result in 450 million illnesses [1,2,3]. These infections are ubiquitous with high prevalence among the poor and socioeconomically deprived communities where overcrowding, poor environmental sanitation, low level of education and lack of access to safe water are prevalent [4], trapping them in a perennial cycle of poverty and destitution [5]. These parasitic diseases contribute to economic instability and social marginalization; and the poor people of under developed nations experience a vicious cycle of under nutrition and repeated infections leading to excess morbidity with children being the worst affected [2,6].

Of these illnesses, infections by STH have been increasingly recognized as an important public health problem and most prevalent of IPIs [7]. STH infections caused by *Ascaris lumbricoides*,

*Trichuris trichiura* and hookworm (*Necator americanus* and *Ancylostoma duodenale*) are most significant in the bottom billion of the world's poorest people (i.e., <US\$1.25 per day) [8]. To date, approximately one third of the world's population is infected with at least one species of STH, with *A. lumbricoides* infecting 800 million people, *T. trichiura* 600 million, hookworm 600 million and resulting in up to 135,000 deaths annually [5].

With regards to intestinal protozoan infections, giardiasis caused by *Giardia duodenalis*, is the most predominant protozoa infection with an estimated prevalence rates ranging from 2.0 to 7.0% in developed countries and 20.0 to 30.0% in most developing countries, affecting approximately 200 million people worldwide [9]. Amoebiasis caused by *Entamoeba histolytica* is another important pathogenic protozoa affecting approximately 180 million people, of whom 40,000 to 110,000 succumbed to death annually [10]. The opportunistic protozoa, *Cryptosporidium* sp. has also emerged as an important cause of diarrhoeal illnesses worldwide particularly in young children and immunocompromised patients with a prevalence of 4% in developed countries and three to four times more frequent in developing countries [11].