CURRENT SITUATION OF *GIARDIA* AND *CRYPTOSPORIDIUM* AMONG ORANG ASLI (ABORIGINAL) COMMUNITIES IN PAHANG, MALAYSIA

AK Mohammed Mahdy, Johari Surin, YAL Lim and MS Hesham Al-Mekhlafi

Department of Parasitology, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia

Abstract. A cross-sectional study on the distribution of *Giardia intestinalis* and *Cryptosporidium* species was conducted among the Orang Asli communities at Pos Betau, Pahang, Malaysia. Fecal samples were collected from 316 participants, age between 1-76 years (156 males and 160 females). The samples were examined using trichrome staining technique for *G. intestinalis*, and *Cryptosporidium* species were detected using modified acid-fast staining technique. Biodata were also collected through a pre-tested standard questionnaire. The overall prevalence rates were 17.1% and 4.1%, for giardiasis and cryptosporidiosis, respectively. The study indicated that there was a significant difference in the infection rate of *G. intestinalis* between age groups, with infections being higher in children ($p < 0.05$). However, cryptosporidiosis and giardiasis were not found to be gender biased. This study concludes that giardiasis and cryptosporidiosis are still public health problems in the Orang Asli communities in Malaysia, and special attention should be given to those in the high-risk groups.

INTRODUCTION

Human giardiasis and cryptosporidiosis have been recognized as the most common causes of protozoal diarrhea worldwide leading to significant morbidity and mortality in developing and industrialized nations (Marshall *et al*, 1997; Clark, 1999). Although foods and drinking water have been considered as the most common route of transmission of *G. intestinalis* and *Cryptosporidium*, person-to-person and zoonotic transmission of these protozoa may occur (Marshall *et al*, 1997; Monis and Thompson, 2003).

The ability of *G. intestinalis* and *Cryptosporidium* to survive for weeks to months in the environment and to withstand chlorine disinfection and filtration beside the low infective dose has defied water and health authorities. *Giardia* and *Cryptosporidium* have caused multiple waterborne outbreaks in developed and developing countries (Insulander *et al*, 2005). To date the biggest *Cryptosporidium* waterborne outbreak was the outbreak that occurred in South Milwaukee, USA that affected 403,000 persons, with more than 100 fatal cases (MacKenzie *et al*, 1994). Although livestock have been implicated as the source of waterborne outbreaks in Canada (Fayer *et al*, 2000) and UK (McLauchlin *et al*, 2000), genotyping the isolates in the Milwaukee outbreak has implicated human effluent as the source of water contamination causing the outbreak (Zhou *et al*, 2003).

In immunocompromised hosts, *Cryptosporidium* causes severe and life-threatening diarrhea. However, it induces self-limiting diarrhea in immunocompetent persons. In developing countries, cryptosporidiosis in early childhood may be associated with subsequent impaired physical development and cognitive function (Guerrant *et al*, 1999), even if the infection is asymptomatic (Checkley *et al*, 1998). Although giardiasis is most often asymptomatic, acute infection causes diarrhea and may be associated with the clinical manifestation of malabsorption. Chronic giardiasis in the children is usually associated with failure to thrive. A significant association between giardiasis and malnutrition has been documented (Gendrel *et al*, 2003).

In Malaysia, giardiasis has been reported as a predictor of malnutrition (Al-Mekhlafi *et al*, 2005). Although cryptosporidiosis is prevalent in Malaysia, it has not received much attention especially in communities, where the infection is still underestimated. To our knowledge, the

Correspondence: Professor Johari Surin, Department of Parasitology, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia.
Tel: 603-7967-4746; Fax: 603-7967-4754
E-mail: joharis@ummc.edu.my

last reported prevalence of *Cryptosporidium* infection among the Orang Asli was in 1997 (Lim *et al*, 1997). Thus, this study sought to determine the occurrence of *G. intestinalis* and *Cryptosporidium* among Orang Asli communities in Pahang, Malaysia.

MATERIALS AND METHOD

The study was conducted in Orang Asli villages in Pos Betau, Pahang, about 200 km from Kuala Lumpur. All villages are located near the river. Houses are made of wood or bamboo and basic amenities, such as electricity and piped water supply are provided free by the government. Most of the Orang Asli daily activities, such as swimming, playing, washing clothes and household items are carried out at the river. For some inhabitants, the river also doubles up as a "toilet" and the river water is used to clean themselves after defecation. During the period of study, no livestock were seen in the study area. However, many household pets, such as dogs, were noted.

A total of 316 Orang Asli individuals volunteered to participate in this study. Of these participants, 156 were males and 160 were females. The ages of the participants ranged from 1 to 76 with a median of 10 years. Stool samples were collected in screw-capped containers and preserved in polyvinyl alcohol. For the identification of *G. intestinalis*, fecal smears were made from the preserved stool, after centrifugation at 2,500 rpm for 5 minutes, and stained with trichrome. The smear was then examined by light microscopy under the magnification of 1,000x. A smear was reported as positive if *Giardia* cysts or trophozoites were detected. *Cryptosporidium* was diagnosed by using modified Ziehl-Neelsen staining technique. Biodata were collected via pretested standard questionnaire. Data were analysed using SSPS program for windows version 11.5. The associations between the prevalence and dependent variables were tested using Fisher's exact test and the significance was defined as $p < 0.05$. The study was approved by the research and ethics committee of Faculty of Medicine, University of Malaya, Malaysia.

RESULTS

The prevalence and distribution of *G. intestinalis* and *Cryptosporidium* are indicated in Table 1. The overall prevalence of *G. intestinalis* was 17.1%. There was a decrease in prevalence with increasing age. Children less than 15 years of age were at the highest risk ($p< 0.05$). Females had a higher infection rate compared with males; however, the difference was statistically non-significant.

Positive rate of *Cryptosporidium* was determined to be 11(4.1%) of the 271 examined. The highest prevalence of *Cryptosporidium* was among the 7-15 age groups. Females were also more infected than males. No significant association between *Cryptosporidium* infection and age or gender was noted.

DISCUSSION

During the past decade, *G. intestinalis* and *Cryptosporidium* have emerged as important pathogenic enteric protozoa. These parasites have gained great attention from public health authorities due to their significant association with childhood malnutrition, immunosuppressed patients especially those with AIDS (in case of *Cryptosporidium*), and their responsibility for several waterborne outbreaks in developed and developing countries. In 2004, WHO has added *Giardia* and *Cryptosporidium* into the 'Neglected Diseases Initiative,' which is a comprehensive approach to combat parasitic, viral, and bacterial diseases that impair the ability to achieve full potential and impair development and socio-economic improvements.

This study has determined the prevalence of *G. intestinalis* to be at 17.1%. This rate is generally in agreement with studies conducted among the Malaysian Orang Asli communities at different locations whereby prevalence of giardiasis among these people is usually above 15% (Lim *et al*, 1997; Al-Mekhlafi *et al*, 2005). Similar finding has also been reported in rural Malay communities (Norhayati *et al*, 1998). It would seem that factors influencing occurrence of giardiasis is related to living conditions rather than ethnicity. Che Ghani *et al* (1987) and Lai

Table 1
Prevalence of *G. intestinalis* and *Cryptosporidium* among Orang Asli population according to age and gender.

Age (years)	*G. intestinalis*			*Cryptosporidium*		
	No. examined	No. infected	Prevalence (%)	No. examined	No. infected	Prevalence (%)
≤ 6	17	4	23.5	14	0	0.0
7-15	239	48	20.1	204	9	4.4
≥ 16	60	2	3.3	53	2	3.8
Gender						
Male	156	26	16.7	136	5	3.6
Female	160	28	17.5	135	6	4.4
Total	316	54	17.1	271	11	4.1

(1992) have found that no significant differences in prevalence of giardiasis among major ethnic groups, such as Malays, Chinese, and Indians living in urban Malaysian areas. Furthermore, human giardiasis in Malaysia is more prevalent in rural communities (Norhayati *et al*, 1998; Al-Mekhlafi *et al*, 2005) than urban communities (Che Ghani *et al*, 1987; Lai, 1992). This could be attributed to the low socio-economic status and improper sanitation in rural areas.

The prevalence of *Cryptosporidium* was found to be 4.1% in this study. This result was consistent with a previous study on the prevalence of *Cryptosporidium* among Orang Asli community in Selangor (Lim *et al*, 1997). Several studies that had aim to determine the occurrence of cryptosporidiosis among children in pediatric wards in Malaysian hospitals indicated that the prevalence ranged from 0.9% to 11% (Ludin *et al*, 1991; Lai, 1992; Menon *et al*, 2001). In AIDS patients, cryptosporidiosis was 3.03% (Lim *et al*, 2005) and 23% (Kamel *et al*, 1994).

Our study indicated that children are at significantly higher risk of getting *Giardia* infection. This result was in agreement with previous studies (Lim *et al*, 1997; Norhayati *et al*, 1998; Laupland and Church, 2005). The possible reasons for this age-dependent pattern are probably related to children's behaviors (*eg*, sharing things among themselves, putting objects into the mouth, etc) and exposure to sources of fecal contamination because of their poor personal hygiene practices. Otherwise, the reason for higher infections in children may also be related to the lack of effective immunity. Children, in our study, had higher infection rates for cryptosporidiosis compared to adults. This finding was consistent with previous studies in several tropical countries, which confirmed that *Cryptosporidium* infection was commonly found in children (Samie *et al*, 2006). However, the differences were statistically non-significant.

Although females were slightly more likely to be infected with *Giardia* and *Cryptosporidium*, the difference was non-significant. Similar finding were also reported in Malaysia for *Giardia* infection (Lim *et al*, 1997; Norhayati *et al*, 1998; Al-Mekhlafi *et al*, 2005) and in South Africa for *Cryptosporidium* infection (Samie *et al*, 2006).

Humans may be the most possible potential source of *Giardia* and *Cryptosporidium* infection in Orang Asli communities, with direct transmission from person-to-person or indirectly though river water contamination. Sewage is usually discharged into the river, and some people may defecate in the river. Lim and Ahmad (2004) documented that 66.7% and 5.6% of river water samples, collected from a river located adjacent

to an Orang Asli community, were positive for *Giardia* cysts and *Cryptosporidium* oocysts, respectively. Zoonotic transmission should also be considered as numerous dogs have been noted living closely with human. Recent molecular epidemiological studies have implicated dogs as source of human infection with *Giardia* (Traub *et al*, 2004). Although livestock have been implicated in zoonotic transmission of *Cryptosporidium* (Fayer *et al*, 2000), they were not observed in this study location. In addition, domestic pets have rarely been implicated as a source of cryptosporidiosis.

It could be concluded that giardiasis and cryptosporidiosis are still public health problems and should receive more attention from public health authorities. Mass treatment should be combined with appropriate health education programs to prevent re-infection. The control of fecal disposal could be the most practical intervention to reduce the spread of giardiasis and cryptosporidiosis. Molecular tools should be applied to identify species and genotypes/ subgenotypes of these protozoans for better understanding of the epidemiology of these diseases.

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