

## Research Article

# Detection of *Cryptosporidium* and *Cyclospora* Oocysts from Environmental Water for Drinking and Recreational Activities in Sarawak, Malaysia

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Received 9 August 2017; Accepted 16 October 2017; Published 6 November 2017

Academic Editor: Christen Rune Stensvold

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Cryptosporidiosis and cyclosporiasis are caused by waterborne coccidian protozoan parasites of the genera *Cryptosporidium* and *Cyclospora*, respectively. This study was conducted to detect *Cryptosporidium* and *Cyclospora* oocysts from environmental water abstracted by drinking water treatment plants and recreational activities in Sarawak, Malaysia. Water samples (12 each) were collected from Sungai Sarawak Kanan in Bau and Sungai Sarawak Kiri in Batu Kitang, respectively. In addition, 6 water samples each were collected from Ranchan Recreational Park and UNIMAS Lake at Universiti Malaysia Sarawak, Kota Samarahan, respectively. Water physicochemical parameters were also recorded. All samples were concentrated by the iron sulfate flocculation method followed by the sucrose floatation technique. *Cryptosporidium* and *Cyclospora* were detected by modified Ziehl-Neelsen technique. Correlation of the parasites distribution with water physicochemical parameters was analysed using bivariate Pearson correlation. Based on the 24 total samples of environmental water abstracted by drinking water treatment plants, all the samples (24/24; 100%) were positive with *Cryptosporidium*, and only 2 samples (2/24; 8.33%) were positive with *Cyclospora*. Based on the 12 total samples of water for recreational activities, 4 samples (4/12; 33%) were positive with *Cryptosporidium*, while 2 samples (2/12; 17%) were positive with *Cyclospora*. *Cryptosporidium* oocysts were negatively correlated with dissolved oxygen (DO).

## 1. Introduction

*Cryptosporidium* and *Cyclospora* are coccidian protozoan parasites that are the causative agents of waterborne outbreaks worldwide with faecal oral route as the infection transmission. *Cryptosporidium* is one of the leading pathogens which are responsible for majority diarrhoeal infections [1]. There are two most common species infecting human, namely, *Cryptosporidium hominis* and *Cryptosporidium parvum*. Infectious dose of the parasite varies upon human immune status. A study on human volunteers revealed that the median infectious dose of *C. parvum* (ID<sub>50</sub>) infection is 132 oocysts for healthy individuals and as low as 30 oocysts can initiate an infection [2]. A person without previous exposure to cryptosporidiosis is more susceptible to low dose of oocyst

as no anti-*C. parvum*-specific immunoglobulins is found in the body [3].

*Cryptosporidium* oocyst has become a concern for the water industry as it is infectious, robust in the environment, and resistant to disinfectants (chlorine and chloramines) and can compromise filter bed of the water filtration system [4, 5]. In other developed countries such as the United States and Canada, *Cryptosporidium* represents one of the key parameters for determining the safety of environmental water as drinking water supply [6, 7] and was classified under Category 1 in Unitary Environmental Classification of Water- and Excreta-Related Disease.

*Cyclospora cayetanensis* can also cause prolonged diarrhoea, nausea, and abdominal cramps, and human is the only natural host of the parasite [4]. The parasite is resistant to