

RESEARCH

Open Access

# Increased detection of *Plasmodium knowlesi* in Sandakan division, Sabah as revealed by PlasmoNex™

Xiang Ting Goh<sup>1</sup>, Yvonne AL Lim<sup>1\*</sup>, Indra Vythilingam<sup>1</sup>, Ching Hoong Chew<sup>2</sup>, Ping Chin Lee<sup>3</sup>, Romano Ngui<sup>1</sup>, Tian Chye Tan<sup>1</sup>, Nan Jiun Yap<sup>1</sup>, Veeranoot Nissapatorn<sup>1</sup> and Kek Heng Chua<sup>2\*</sup>

## Abstract

**Background:** *Plasmodium knowlesi* is a simian malaria parasite that is widespread in humans in Malaysian Borneo. However, little is known about the incidence and distribution of this parasite in the Sandakan division, Malaysian Borneo. Therefore, the aim of the present epidemiological study was to investigate the incidence and distribution of *P. knowlesi* as well as other *Plasmodium* species in this division based on a most recent developed hexaplex PCR system (PlasmoNex™).

**Methods:** A total of 189 whole blood samples were collected from Telupid Health Clinic, Sabah, Malaysia, from 2008 to 2011. All patients who participated in the study were microscopically malaria positive before recruitment. Complete demographic details and haematological profiles were obtained from 85 patients (13 females and 72 males). Identification of *Plasmodium* species was conducted using PlasmoNex™ targeting the 18S ssu rRNA gene.

**Results:** A total of 178 samples were positive for *Plasmodium* species by using PlasmoNex™. *Plasmodium falciparum* was identified in 68 samples (38.2%) followed by 64 cases (36.0%) of *Plasmodium vivax*, 42 (23.6%) cases of *P. knowlesi*, two (1.1%) cases of *Plasmodium malariae* and two (1.1%) mixed-species infections (i.e., *P. vivax*/*P. falciparum*). Thirty-five PlasmoNex™ positive *P. knowlesi* samples were misdiagnosed as *P. malariae* by microscopy. *Plasmodium knowlesi* was detected in all four districts of Sandakan division with the highest incidence in the Kinabatangan district. Thrombocytopenia and anaemia showed to be the most frequent malaria-associated haematological complications in this study.

**Conclusions:** The discovery of *P. knowlesi* in Sandakan division showed that prospective studies on the epidemiological risk factors and transmission dynamics of *P. knowlesi* in these areas are crucial in order to develop strategies for effective malaria control. The availability of advanced diagnostic tool PlasmoNex™ enhanced the accuracy and accelerated the speed in the diagnosis of malaria.

## Background

Malaria, a tropical disease caused by infection with single-celled parasites of the genus *Plasmodium*, is one of the most deadly parasitic diseases in the world. According to the World Malaria Report 2011, an estimated 3.3 billion people were at risk of malaria in 2010. Of this total, 2.1 billion people were at low risk whereas

1.2 billion people were at high risk (>one case per 1,000 population) and living mostly in the WHO African (47%) and Southeast Asian regions (37%) [1]. Malaria is the most common vector-borne parasitic disease in Malaysia, responsible for 20–40 deaths per year over the last decade, and it is estimated that 3% of total Malaysian population live in malaria risk areas. Around 80% of nationwide cases are found in Malaysian Borneo with 58% occurring in the northern state of Sabah and less than 20% of total malaria cases occurring in Peninsular Malaysia [2].

In Sabah, malaria is transmitted by various *Anopheles* mosquitoes, such as *Anopheles balabacensis*, *Anopheles sundaicus* and *Anopheles flavirostris* [3]. Traditionally,

\* Correspondence: limailian@um.edu.my; khchua@um.edu.my

<sup>1</sup>Department of Parasitology, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia

<sup>2</sup>Department of Molecular Medicine, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia

Full list of author information is available at the end of the article