

Identification of *Plasmodium vivax* and *Plasmodium falciparum* in the Northern areas (District Malakand) of Khyber Pakhtunkhwa, Pakistan

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Abstract

The current study was designed to investigate the occurrence of malarial infections in the Northern areas (District Malakand) of Khyber Pakhtunkhwa, Pakistan. Malarial parasites were detected in the blood samples of suspected patients of the infection. Out of 210 suspected cases of malaria, 47 (22.38%) were found to be positive for the malarial parasite in blood smear slides. Out of positive cases, 28 (59.57%) were identified as *Plasmodium vivax* infection and 19 (40.42%) cases with *P. falciparum*. No case was found having both the malarial parasites. This research work evidenced that *P. falciparum* and *Plasmodium vivax* are steadily becoming more dangerous and deadly in rural areas of Khyber Pakhtunkhwa in general, and particularly in District Malakand. It is therefore highly necessary to take immediate and effective measures to minimize death toll in these areas.

Keywords: Malarial infection, *Plasmodium vivax* and *P. falciparum*, rural areas, Malakand.

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INTRODUCTION

Malarial infection is one of the most devastating infections in the World. The causative agent of malarial infection is the parasite of genus plasmodium. Out of 5 popular species, *Plasmodium vivax* and *Plasmodium falciparum* are most deadly and causing most severe and mortal infection (Sawaswong *et al.*, 2015). It was estimated that in 24 endemic countries more than 3 billion people live under the malarial risk (Korenromp, 2005). According to malaria control program, 500,000 malaria infections noticed each year in Pakistan, along with 50,000 malaria-attributable death cases reported every year (Mukhtar, 2006). In 2012, 207 million cases were prevalent and 627,000 deaths were reported. About 3.4 billion individuals are at malarial risks, globally (Port *et al.*, 2014; WHO, 2013).

Pakistan's climate varies from tropical to temperate with dry environments along the southern coast, and elevation varies from sea level to almost 9,000 meters. *Plasmodium vivax* and *Plasmodium falciparum* are causing infections in Pakistan almost 64 % and 36 %, respectively

(WHO, 2011), and primarily malarial infection noticed in the regions of Sindh, Baluchistan, Federal administered Tribal areas and Khyber Pakhtunkhwa. A case report was studied in Italy, a Pakistani girl spent a vacation in her home country and was died when return back to Italy. Later it was found that the girl transport a malignant malarial infection from her home country, a well recognize region for malarial contagion (Pusiol *et al.*, 2015). The objective of the current study was to determine the prevalence rate of malarial infection among the human individuals of Northern areas (District Malakand) of Khyberpakhtunkhwa, Pakistan.

MATERIALS AND METHODS

The study was carried out in different locations of Malakand district to screen different species of malarial parasite with reference to gender and age of patients. A total of 210 patients (111 male and 99 female) were screened for the identification of *Plasmodium vivax* and *Plasmodium falciparum*. Malaria infection was confirmed by two methods:

Detection by slide method in which field staining was used. Field stain is known to be a histological technique for blood smears staining. It is used for thin and thick staining of blood smears in order to study malarial infection. Field's stain belong to Romanowsky stain and mostly used for quick staining of the samples (Chuang *et al.*, 1989).

Malarial Parasite detection by ICT method in which the presence of only control line "C" presents negative results while two color lines ("T" band and "C" band) indicate positive tests as shown in figure 1. Data obtained was analyzed statistically by SPSS version 16.

RESULTS

The overall incidence of malarial infection was 22.38% as confirmed by staining and ICT results (Figure 1). *P. vivax* was detected to be the highest (59.59 %) as compared to that of *P. falciparum* (40.42 %). Infection in males was 18.81% and in females 28.28% as shown in table 1. No case was found having *P. malariae* and *P. ovale*. *P. falciparum* was found in 7 male and 12 female individuals with percentile values of 3.33 % and 5.71 % respectively while *P. vivax* was found in 13 male and 15 female individuals with percentile values of 6.19 % and 7.14 % respectively (Table 2).

P. falciparum was positive with high number (5.71%) in patients greater than 41years old and lowest in age

group 21-30 years (0.95%), while no individual was found positive in less than 20 years patients. *P. vivax* was positive with high number in patients greater than 41years old (5.71%) and lowest in age group 10-20 years (0.95%) while no individual was found positive in less than 10 years patients. No sample was to be found have both parasites species (Table 3).



Fig. 1. ICT strip showing positive results

Table 1. Sex-wise incidence of malarial infection in Malakand District

Total Samples	Total Positive n (%)	Male Positive n (%)	Female Positive n (%)
210	47 (22.38%)	28 (28.28%)	19 (18.81%)

Table 2. Malarial parasite stratified by gender between 210 study applicants.

Sex		Prevalence		
		<i>P. falciparum</i> n (%)	<i>P. vivax</i> n (%)	<i>Pf + Pv</i> n (%)
Sex	Male	7 (3.33)	13 (6.19)	0 (0)
	Female	12 (5.71)	15 (7.14)	0 (0)
	Total	19 (40.42)	28 (59.57)	0 (0)

Pf: *P. falciparum*; Pv: *P. vivax*

Table 3. Malarial parasite stratified by age between 210 study applicants.

Age groups	Years	Prevalence		
		<i>P. falciparum</i> n (%)	<i>P. vivax</i> n (%)	<i>Pf + Pv</i> n (%)
Age groups	≤ 10	0 (0)	0 (0)	0 (0)
	10-20	0 (0)	2 (0.95)	0 (0)
	21-30	2 (0.95)	4 (1.90)	0 (0)
	31-40	5 (2.30)	10 (4.76)	0 (0)
	>41	12 (5.71)	12 (5.71)	0 (0)

Pf: *P. falciparum*; Pv: *P. vivax*

DISCUSSION

The incidence of *P. vivax* (59.57%) was greater than *P. falciparum* (40.42%). Our results are in accordance to a previous study that showed that *P. vivax* infection was detected at high ratio (62.5%) as compared to *P. falciparum* infection (36%) (Jamal *et al.*, 2005). The *P. vivax* infection was found at high rate 72.4% as compare to *P. falciparum* (24.1%) (Idris *et al.*, 2007). A study conducted in Karachi and other Sindh regions observed that *P. vivax* infection was noticed almost double as compared to *P. falciparum* (Mahmood, 2005). Another study reported the prevalence ration of *P. falciparum* at high level in various district of Sindh (Nizamani *et al.*, 2006). *Falciparum* malarial infection has a variety of complications such as algid malaria, renal failure and cerebral malaria (Bhalli, 2001).

Many reports are available about the incidence of malarial infection in different regions of Pakistan such as Buner (5.7% *P. vivax*, 1% *P. falciparum*), Muzaffarabad (90.4% *P. vivax*, 0.6% *P. falciparum*), Quetta (66.8% *P. vivax*, 30.7% *P. falciparum*), Sibi (72.3% *P. vivax*, 27.6% *P. falciparum*), Zhob (51.8% *P. vivax*, 48.1% *P. falciparum*) and Multan (60.5% *P. vivax*, 37.2% *P. falciparum*) (Yar *et al.*, 1998; Jan and Kiani, 2001; Muhammad and Hussain, 2011). The prevalence of dengue fever in Arid Agriculture University Rawalpindi was calculated 17% (Ikhlak *et al.*, 2016).

Our results showed that malarial infection was prevalent (5.71%) in patients greater than 41years old. Pediatric age is also susceptible to malarial infection and 200 cases were found positive in a study conducted by Jamal *et al.* (2005). Cerebral malarial infection was noticed at high rate in male individuals and pregnant women were noticed a vulnerable group to that infection in Khyber Pakhtunkhwa (Iqbal *et al.*, 2006). Jalal-ud-din and Ally (2006) examined malarial infection among 160 children in Mansehra region and 142 cases were found having *P. vivax* infection and 12 cases have *P. falciparum* infection.

No positive case was observed having both the parasites i.e. *P. vivax* and *P. falciparum*, similar study was conducted in Multan ditrict by Yar *et al.* (1998) who observed that the ratio of positive cases for both parasites were 2.3% (Yar *et al.*, 1998). However, similar ratio (2.3 %) for both malarial infections was observed in Quetta (Sheikh *et al.*, 2016). A previous study conducted in Islamabad demonstrated that among 801 patients, 536 were positive for *P. vivax* and 128 for *P. falciparum*, and number of cases having both the parasites was 43 (6%) (Khattak *et al.*, 2013). No case was observed for *P. malariae* or and *P. ovale* infection, similar observations were found in a study conducted in Multan district (Yar *et al.*, 1998). The results showed that the malarial parasite infection was quit high in study area so the health agencies both government or private require concentrating on these health risk issues and to educate the communities about the health effects of

malarial infection and also direct them about its protection measure strategy.

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CONFLICT OF INTEREST

There is no conflict of interests regarding the publication of this paper.

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