

PREVALENCE OF HUMAN MALARIA INFECTION IN BORDERING AREAS OF BALOCHISTAN WITH SINDH PROVINCE: DISTRICT JAFFARABAD

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ABSTRACT

Objective: The present study was designed to assess the prevalence of malarial infections in human population of district Jaffarabad, the hottest areas of Balochistan, Pakistan.

Methodology: The study was conducted in district Jaffarabad (10 localities) from July, 2006 to June, 2008. Malarial parasites were identified in the blood slides of 6283 suspected patients of the disease.

Results: Out of 6283 suspected cases of malaria, 2968 (47.2%) were found to be positive for malarial parasite in blood smear slides. Out of positive cases, 2407 (81%) were identified as *Plasmodium vivax* infection, 561 (18.9%) cases with *P. falciparum*. However, seasonal variation was also noted with the highest (250/274) infection of *P. vivax* in April and lowest (172/249) in December. The prevalence was higher (77.9%) in males. Age wise, the prevalence of the disease was 84.3% in the age group of 1-10 years and 81% in the age group of 11-20 years. There was no case of *P. malariae* and *P. ovale* detected in the present study. No association was found between types of infection and age groups.

Conclusion: In clinically suspected cases of malaria, slide positivity rate is high. The high prevalence rate of *P. vivax* poses a significant health hazard but of *P. falciparum* also may lead to serious complications like cerebral malaria. The high frequency of human malaria infection should be of great concern for authorities at malaria control program in Pakistan.

Key Words: Malaria, *Plasmodium vivax*, *Plasmodium falciparum*

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INTRODUCTION

Half of the world's population is at risk of malaria, and an estimated 243 million cases led to nearly 863000 deaths in 2008¹. In East Mediterranean Region, *P. falciparum* is the most dominant species of parasites in Djibouti, Saudi Arabia, Sudan and Yemen, but the majority of cases in Afghanistan and Pakistan, and almost all cases in Iran and Iraq are due to *P. vivax*¹. In Pakistan, in 2006, Malaria Disease Surveillance Program registered 3.5 million slides prepared and

127,825 confirmed cases of malaria with Annual Parasite Incidence of 0.8 cases per 1000 population. However, the actual cases load may be 5 times higher since public sector diagnosis facilities do not cover more than 20-30% of the attending patients and other 80% which get their treatment from Private sector². Estimated number of Annual Malaria cases in Pakistan is 1.5 million³. In the country, in 2004, lower malaria incidence was confined to two provinces: Punjab and Azad Jammu & Kashmir (AJK) and two provinces namely Balochistan and Federally Administered Areas (FATA) reported highest malaria incidence, while Sindh and Khyber Pakhtun Khuwa Provinces reported moderate as compared to two last malaria incidence⁴.

In 2000, in Sindh, 5.9% slide positivity rate (SPR) with 65% cases of *P. falciparum* and 35% of *P. vivax* in children, were observed⁵. A review of 120 cases of falciparum malaria has also been published wherein incidence of falciparum malaria was found to be significantly higher during the months of August to November⁶. High incidence of falciparum as compared to vivax

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(65% vs 35%) among 100 positive children for malaria at Baqai Medical University has been recorded⁷. In 2006, 3.1% SPR with 58% *P. falciparum* and 42% *P. vivax* were observed⁸. Mahmood et al.⁹ studied 348 patients with fever at Civil Hospital and Ankle Seria Hospital Karachi from August 2003 to December, 2005 and observed 35% SPR, with *P. falciparum* 88.5% and *P. vivax* 9%. Nizamani et al.¹⁰ studied the data of Provincial Malaria Control Program of Sindh and observed more than 68,000 slides reported positive for malarial parasites with an average slide positivity rate of 2.4 %. Average *P. falciparum* ratio in years 2004 and 2005 was 33% and 37.2% respectively. Annual parasite incidence was unacceptably high and *P. falciparum* ratio was found increasing in many districts of Sindh. Prevalence of malarial parasite in human blood in Karachi was studied and out of 2457 samples, 311 of the samples were found to be positive¹¹. In south Punjab, 41% were found to be infected by Plasmodium species¹². In Khyber Pakhtun Khuwa, cerebral malaria was recorded more common in males (64%) and most vulnerable group was found pregnant women¹³. Falciparum malaria is the major problem for Afghan refugees in Khyber Pakhtun Khuwa¹⁴.

In Balochistan Province too, cerebral malaria is a major community problem. Khadim¹⁵ observed 11.7% positive cases of malaria from patients at CMH, Zhob. Malaria Control Program Balochistan (M.C.P.B.)^{16,17,18} observed slide positivity rate 13.5% in 2004 and 2005, and 12.9% in 2006 in the districts of Lasbella, Qilla Abdullah, Mastung, Khuzdar, Kohlu, Zhob, Kharan, Sibi and Turbat. Shaikh et al.¹⁹ studied endemicity of malaria in Quetta from January 1994 to December, 1998 and observed 34.8% positive smears, with 66.8% *P. vivax* and 30.7% *P. falciparum*. Farooq et al.²⁰ studied 505 suspected malaria patients from district Khuzdar and observed higher prevalence of *P. falciparum* (69%) than of *P. vivax* (24%) and 7% mixed infection.

Keeping in view the high mortality rate of malaria infection in Jaffarabad areas published in local news paper, the present investigation was carried out to know exactly the positivity rate and the dominant Plasmodium species. Jaffarabad district (28° Lat, 67° Long, Height 78 M) is basically an arid zone, known as a hypoendemic area of malaria and has recently experienced changes in ecosystem due to flood is situated at the Eastern border of the Balochistan Province adjoining with Sindh. It is one of the hottest areas in Pakistan (highest temperature range of 45-50 °C) where cases of human malaria are very common. This is the first study of its kind conducted on

patients suffering from malaria in this area.

METHODOLOGY

A two years study was conducted during July, 2006 to June, 2008 in the areas of district of Jaffarabad to record and screen the species of malarial parasites from the blood of human patients suffering from malaria by adopting two techniques: Active case detection (ACD) and Passive case detection (PCD). Both Passive Case Detection (PCD) and Active Case Detection (ACD) methods were used for detection of malaria cases. In PCD 9 health facilities (1 District Hospital, 3 Basic Health Unit and 5 Private clinics) have collaborated. For ACD, 24 visits were conducted during two year study.

Passive Case Detection (PCD) Technique²¹ where in blood films were taken from the patients presenting themselves to a health station with symptoms of shivering and fever or a history suggestive of malaria. The other technique is active case detection (ACD)²¹ in which home visits were made on monthly basis with the help of Malik/ Head to the persons with sign or symptoms of malaria and both thin and thick blood films were prepared. Blood slides were taken back to the laboratory where they were stained in Giemsa's stain following the techniques described by Paniker²¹. Identification of species of malarial parasites were made from the keys furnished by Chiodini et al.²² and Paniker²¹.

Data was analyzed using SPSS version 11.0. Frequency along with percentages were used to describe the data. Chi-square test was applied to check the association between age and types of infection. P-value <0.05 was considered significant.

RESULTS

A total of 6283 blood smears were prepared from the age groups ranging from 1 year to 21 years and above residing in 10 different localities of Jaffarabad viz: Usta Mohammad city, Dera Allah Yar, Dergi, Khairpur, SohbatPur, Adam Pur, Hairdin, Goth Ismail Khan, Goth Sohrab Khan and ManjhiPur (PCD: 5585, and ACD: 698) (Table 1). However, variations were observed among different localities having different environment and hygienic conditions.

The over all prevalence of Plasmodium slide positivity was observed to be higher 47.2% (2968/6283) whereas *P. vivax* (Figure 1) positivity was observed to be highest (81%: 2407/2968) as compared with that of *P. falciparum* (Figure 2) (18.9%:561/2968).

Slide positivity rate (SPR) area- wise: In Goth

Ismail Khan area (Table 1) high SPR of 91.1% (215/236) and 90.1% (294/326) was observed in Dergi area.

Slide positivity rate (SPR) month- wise: High SPR (Table 2) of 91.2 % (250/274) and 88.8%

(263/296) was observed in the month of April and October respectively.

Slide positivity rate (SPR) age- wise: Among Plasmodium slide positivity (Table 3), children (1-10 years), 84.3% (367/435), in the age group of

Figure 1: Showing gametocyte and Ring stage of Plasmodium vivax in blood smear (1000x) of malaria patient of District Jaffarabad

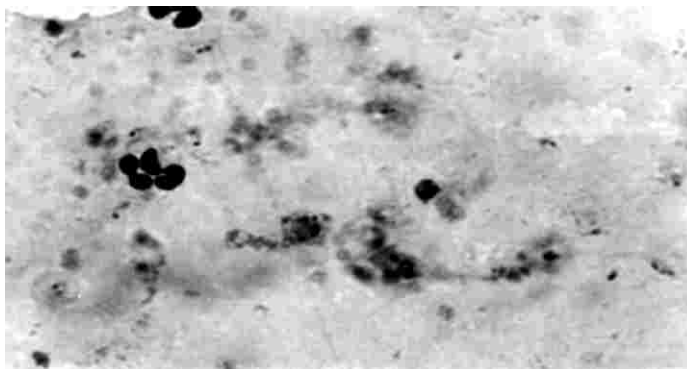


Figure 2: Showing gametocyte and Ring stage of Plasmodium falciparum in blood smear (1000x) of malaria patient of District Jaffarabad

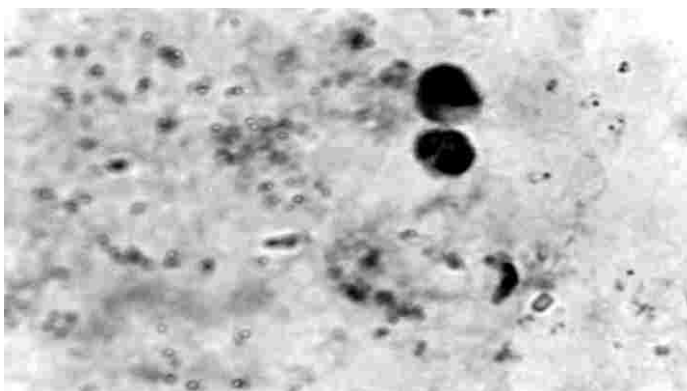


Table 1: Area-wise Malaria infection in district Jaffarabad

S.No.	Area	Slides Examined	% of + ve	P. vivax (%)	P. falciparum (%)
1.	Usta Mohammad city	920	41.4	324 (85)	57 (14.9)
2.	Dera Allah Yar	802	44.7	280 (77.9)	79 (22)
3.	Dergi	761	42.8	294 (90.1)	32 (9.8)
4.	Khairpur	680	45.8	257 (82.3)	55 (17.6)
5.	SohbatPur	523	36.5	148 (77.4)	43 (22.5)
6.	Adam Pur	479	51.9	201 (80.7)	48 (19.2)
7.	Hair Din	439	51.0	185 (82.5)	39 (17.4)
8.	Goth Ismail Khan	472	50.0	215 (91.1)	21 (8.8)
9.	Goth Sohrab Khan	588	59.6	307 (87.4)	44 (12.5)
10.	ManjhiPur	619	54.7	196 (57.8)	143 (42.1)
Total		6283	47.2	2407 (81)	561 (18.9)

Table 2: Month-wise Malaria Infection

Month	Slides Examined	% of + ve	P. vivax (%)	P. falciparum (%)
July 2006-08	324	41.6	118 (87.4)	17 (12.5)
August 2006-08	408	46.8	165 (86.3)	26 (13.6)
September 2006-08	590	48.8	251 (87.1)	37 (12.8)
October 2006-08	637	46.9	263 (88.8)	33 (11.1)
November 2006-08	683	44.5	244 (80.2)	60 (19.7)
December 2006-08	478	52.0	172 (69)	77 (30.9)
January 2007-08	571	40.6	190 (81.8)	42 (18.1)
February 2007-08	549	50.4	209 (75.4)	68 (24.5)
March 2007-08	612	51.6	233 (73.7)	83 (26.2)
April 2007-08	547	50.0	250 (91.2)	24 (8.7)
May 2007-08	436	56.8	193 (77.8)	55 (22.1)
June 2007-08	448	35.2	119 (75.3)	39 (24.6)
Total	6283	47.2	2407 (81)	561 (18.9)

Table 3: Age-wise Over all Malaria infection

Age (Years)	Slides Examined	No. of +ve	Over all % infection	P. vivax (%)	P. falciparum (%)
1- 10	1324	435	32.8	367 (84.3)	68 (15.6)
1 - 20	2611	1322	50.6	1071 (81)	251 (18.9)
21- above	2348	1211	51.5	969 (80)	242 (19.9)
Total	6283	2968	47.2	2407 (81)	561 (18.9)

11-20 years 81% (1071/1322), and in the age group of 21 years and above 80% (969/1211) were positive for *P. vivax*.

Slide positivity rate (SPR) sex- wise: High SPR was observed 77.9% (2314/2968) in male and 22.% (654/2968) in female.

In the present study no case of mixed infection was seen.

Table 1 (area-wise) was statistically analyzed to test whether there is any association between types of infection and age groups through X^2 at 5% level of significance, X^2 calculated i.e. 3.96527. P-value < 0.05 was considered significant.

DISCUSSION

Malaria is a deadly mosquito-borne disease, which takes almost one million lives and afflicts as many as half a billion people worldwide annually. Malaria still remains a major cause of morbidity in Pakistan, and figures high on the list of health priorities. The disease mainly affects the

less prosperous districts with sub-optimal quality of health care service delivery, lying along the international borders with Iran and Afghanistan. Pakistan with an estimated burden of 1.6 million cases annually has been categorized in group-3 countries of the Eastern Mediterranean Region, along with Afghanistan, Djibouti, Somalia, Sudan and Yemen; sharing 95% of the total regional burden. The National Health Management Information System (HMIS) reported 4.5 million suspected malaria cases of malaria in Pakistan in 2008, comprising 16% of all outpatient attendances at Primary Health Care health facilities; while the confirmed cases of malaria during the same period were 104454 of which 30% were due to *Plasmodium falciparum*.

In 2009 the case load was almost doubled reaching 198,649 cases, with 39% *falciparum* cases. Most of these districts are located in Balochistan, FATA, and Khyber Pakhtun khuwa and Sindh provinces²³. *P. falciparum* was also reported as dominant species (90.9%) in Karachi¹¹.

High rate of *P. vivax* was also observed in

other parts of the country viz: (98%) Okara²⁴, 90.4% in Muzaffarabad²⁵, 60.5% in Multan²⁶ and 39% in south Punjab¹². High rate of *P. vivax* was also observed in Ziarat (88.5%)¹⁶ and 58.9% in Kohlu²⁷ and 64.7% (ACD) and 54.6% (PCD) in Ziarat²⁸.

No case of *P. malariae* and *P. ovale* was observed in Multan²⁶ and Abbottabad²⁹ and also in the present survey.

CONCLUSION

High prevalence rate (81%) of *P. vivax* poses a significant health hazard in Jaffarabad District. Some 70 to 136 districts of Pakistan (99 million population) and over 13.8 million people have been affected by the recent floods in Pakistan and District Jaffarabad of Balochistan Province is one of the most affected areas. Abundance of mosquito vectors in the presence of highly exposed populations generally enhances the slide positivity rate of infection.

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CONTRIBUTORS

MIYconceived the idea and planned the study. JKK did the data collection and analyzed the study. Both the authors contributed significantly to the research that resulted in the submitted manuscript.