



Short Communication

Incidence of Human Plasmodiasis in Northern and Southern Districts of Khyber Pakhtunkhwa, Pakistan

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ABSTRACT

Total 3968 blood films were prepared from various age groups ranging from below 1 year up to above 50 years during the months of June 2010 to June 2012, residing in Northern (Peshawar, Mardan, Charsaddah, Sawabi, Nowshera) and Southern (Bannu, Lakki, Karak, Kohat, D.I.Khan) districts of Khyber Pakhtunkhwa, Pakistan. All the films were examined by microscopy for the detection of malarial parasites. In the Southern districts, the overall incidence of *Plasmodium* slides positivity was 52.47% of which 91.07% were identified as *Plasmodium vivax* and 6.23% as *P. falciparum* and 2.69 was 43.62%, of which *Plasmodium vivax* were 91.2%, *Plasmodium falciparum* were 6.09% and 2.68% were identified as mixed infections. Malaria was most prevalent in the age group 11 - 20 years (61.68 %), and 40 -50 > (81.63%) years patients. The results also showed that highest infection (72.56%) was found in the month of August and (68.52%) in September, while the lowest prevalence of malaria infection was found in the months of December (7.93%) and in February (12.62%).

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Authors' Contributions

MAK collected the samples, designed the study and performed microscopic analysis. SNK, SK, MA, NA, IA and AJK helped in manuscript writing and statistically analysis.

Key words

Malaria, *P. falciparum*, *P. vivax*, Plasmodiasis.

Malaria is a vector-borne infectious disease caused by protozoan parasite of the genus *Plasmodium* (Snow *et al.*, 2005). *Plasmodium* is primarily transmitted by the bite of an infected female *Anopheles* mosquito, but infections can also occur through exposure to infected blood Products (transfusion malaria) and by congenital transmission (Trampuz *et al.*, 2003). *Plasmodium* has different species. *P. vivax* and *P. falciparum* are the common species detected in human disease. Other species are less common. Malaria occurs throughout the year. Prevalence of malaria shows seasonal variation (Jan and Kiani, 2001).

At present 109 countries are endemic for malaria, out of which 45 countries are within the African region (WHO, 2009). Outside Africa, it is a major public health problem and important contributor to the global burden

of morbidity (Yang *et al.*, 2006). More than 90% of cases of malarial deaths occur in tropical Africa. Poorest countries are suffering with burden of malaria (Panda and Mohapatra, 2004). In European countries most cases are due to *P. malariae* and *P. vivax* (Voittier *et al.*, 2008). South East Asia and India contribute about 70% of the total malaria cases (Dash *et al.*, 2008).

Vivax malaria is a major health problem in Pakistan. In the last decade there has been a six fold increase in *falciparum* malaria, which now comprises 42% of all malaria cases recorded by National Malaria Control Program (MCP) (Shah *et al.*, 1997). Factors associated with the upsurge include of chloroquine resistance across the country (Shah *et al.*, 1997), warmer autumns favoring prolonged transmission (Bouma *et al.*, 1996), and a chronic decline in vector control activities. *Anopheles culicifacies*, the purported primary vector in the Punjab province (Reisen and Boreham, 1982), disappeared by September, whereas *A. stephensi* was found more abundant in North-West Frontier Province (presently Khyber Pakhtunkhwa)

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than *A. culicifacies*. In Pakistan (Duki, Harnai and Sibi), the primary vector species are *A. culicifacies* and *A. stephensi* (MCP, 1999, 2006). In this study, we report incidence of *Plasmodium* in northern and southern districts of Khyber Pakhtunkhwa.

Materials and methods

After informed consent of the subjects a total of 3968 blood smears, both thick and thin, were prepared for the detection of malarial parasites. The current study was carried out in southern districts (Bannu, Lakki, Karak, Kohat, D.I. Khan) and northern districts (Peshawar, Mardan, Charsaddah, Sawabi, Nowshehra) of Khyber Pakhtunkhwa during June 2010 to June 2012. Blood smears were fixed in methyl alcohol and then stained in Giemsa stain for 20-30 min. The slides were screened under microscope for the detection of malarial parasites.

Results and discussion

Table I shows overall incidence of *Plasmodium* prevalence in Southern and Northern districts of Khyber Pakhtunkhwa. Out of total 52.47% prevalence in southern districts 91.07% identified as *P. vivax*, 6.23% as *P. falciparum* and 2.69% as mixed infections. In the northern districts the overall incidence of *Plasmodium* was 43.62% of which *P. vivax* contributed 91.2%, *P. falciparum* 6.09% and mixed infections 2.68%.

Similar type of study in India showed 7.2% population in Gujrat infected with *Plasmodium*, of which 72.47% were identified as *P. vivax*, 24.1% cases were *P. falciparum* and 3.44% cases were mixed infections (Trivedi *et al.*, 2010). Similarly, Zarchi *et al.* (2006) observed infection of *Plasmodium* in Iranian parts of south-east of Caspian

Sea and detected that *P. vivax* was 61%, *P. falciparum* was 20.7% and mixed infection was 18.3%, respectively. Yasinzai and Kakar (2012) showed high incidence of *P. vivax* (81%) and *P. falciparum* (18.9%) in Jaffarabad district.

Idris *et al.* (2007) reported 7.2% positive cases in Abbottabad of which *P. vivax* contributed 72.47%, *P. falciparum* 24.1% and mixed infection was observed 3.44% cases. Akbar *et al.* (2006) observed high prevalence of malarial parasites (96.2%) in children of Mansehra, in which *P. vivax* was 92.2%, and *P. falciparum* was 7.7%. Jan and Kiani (2001) also observed high incidence of *P. vivax* (6.33%) compared to *P. falciparum* (0.67%) in Kashmiri refugees of Muzaffarabad.

Table II shows age wise incidence of *Plasmodium*. The overall highest incidence was in the age group of 41-45 years (81.63%) followed by age groups 11-20 (61.68%) and 21-30 (47.18%). Age group <1-10 was least affected (22.78%). In all of them *P. vivax* was the most dominant infection.

Table III shows incidence of plasmodiasis during different season of the year. Highest slides positivity rate (SPR) was observed in August (72.56%) and September (68.52%) and lowest in December (7.93%) and in February (12.62%). From among southern districts high SPR of *P. vivax* was 92.4% observed in Bannu district followed by 89.7% in Kohat and 89.7% in D.I. Khan, *P. falciparum* on the other hand showed 8.1% incidence in D.I. Khan and 3.4% in Bannu. Likewise in northern districts *P. vivax* showed 92.93% SPR in Peshawar followed by 80.76% in Nowshehra district, *P. falciparum* showed 19.23% incidence in Nowshehra and 2.8% in Charsadda.

Table I.- Overall incidence of malarial parasites in Southern and Northern districts of Khyber Pakhtunkhwa.

Areas	Slides examined	No. of positive (%)	<i>P. vivax</i> (%)	<i>P. falciparum</i> (%)	Mixed (%)
Southern districts					
Bannu	782	409 (52.3)	378 (92.4)	14 (3.4)	17 (4.1)
Lakki	448	192 (42.8)	176 (91.6)	11 (5.7)	5 (2.6)
Karak	411	166 (40.38)	153 (92.1)	13 (7.8)	0 (0.0)
Kohat	385	215 (55.8)	193 (89.7)	15 (6.9)	7 (3.2)
D.I. Khan	663	429 (64.7)	385 (89.7)	35 (8.1)	9 (2.69)
Total	2689	1411 (52.4)	1285 (91.1)	88 (6.2)	38 (2.7)
Northern districts					
Peshawar	673	354 (52.6)	322 (90.9)	21 (5.9)	11 (3.1)
Mardan	174	48 (27.58)	42 (87.5)	6 (12.5)	0 (0.0)
Charsadda	203	98 (48.2)	93 (88.5)	3 (2.8)	2 (1.9)
Sawabi	158	32 (20.2)	27 (84.3)	3 (9.3)	2 (6.2)
Nowshehra	71	26 (36.6)	25 (96.1)	1 (3.8)	0 (0.0)
Total	1279	558 (43.6)	509 (91.2)	34 (6.09)	15 (2.68)

Table II.- Age wise over all incidence of malarial parasites in Northern and Southern districts of Khyber Pakhtunkhwa.

Age groups	Slides examined	Over all infection (%)	<i>P. vivax</i> (%)	<i>P. falciparum</i> (%)	Mixed (%)
<1-10	891	203 (22.78)	203 (100)	0 (0.00)	0 (0.00)
11-20	1172	723 (61.68)	656 (90.73)	45 (6.22)	22 (3.04)
21-30	907	428 (47.18)	401 (93.69)	19 (4.43)	8 (1.86)
31-40	388	117 (30.15)	87 (74.35)	21 (17.94)	9 (7.69)
41-50>	610	498 (81.63)	447 (89.75)	37 (7.42)	14 (2.81)
Total	3968	1769 (49.62)	1794 (91.11)	122 (6.19)	53 (2.69)

Table III.- Month wise incidence of malarial parasites in Northern and Southern districts of Khyber Pakhtunkhwa.

Month	Slides examined	Over all infection (%)	<i>P. vivax</i> (%)	<i>P. falciparum</i> (%)	Mixed (%)
June 2010	779	363 (46.59)	359 (98.89)	4 (1.1)	0 (0)
July	653	434 (66.46)	411 (94.70)	21 (4.83)	2 (0.46)
August	401	291 (72.56)	237 (81.44)	37 (12.71)	17 (5.84)
September	664	455 (68.52)	393 (86.37)	39 (8.57)	23 (5.05)
October	225	140 (62.22)	133 (95.0)	4 (2.85)	3 (2.14)
November	131	38 (29.0)	37 (97.36)	1 (2.63)	0 (0.0)
December	189	15 (7.93)	13 (86.66)	2 (13.33)	0 (0.0)
January	121	26 (21.48)	26 (100)	0 (0.0)	0 (0.0)
February	103	13 (12.62)	12 (92.30)	1 (7.69)	0 (0.0)
March	137	32 (23.35)	32 (100)	0 (0.0)	0 (0.0)
April	197	47 (23.85)	43 (91.48)	4 (8.52)	0 (0.0)
May	107	33 (30.84)	31 (93.93)	2 (6.7)	0 (0.0)
June 2012	261	82 (31.41)	67 (81.70)	7 (8.53)	8 (9.75)
Total	3968	1969	1794 (91.11)	122 (6.19)	53 (2.69)

Similar type of study was done by [Toma et al. \(2001\)](#), in Laos, in which the prevalence rate of malarial parasites in less than 10 years was 40.7%, 11 to 20 years 52.4%, 21 to 30 years 28.6%, 31 to 40 years 25.0%, 41 to 50 years 7.1% and >50 years 26.3%. [Yasinzai and Kakar \(2012\)](#) reported 32.8% in 1-10 years, 50.6% 11-20 years and 51.5% in the age group of 21 years and above. Likewise [Idris et al., \(2007\)](#) reported 48.27% infection in <15 years age group, 8.96% in 15-30 years, 5.51% in 30-45 years, 16.55% in 45-60 years, 13.79% in 60-80 years and 6.89% in 80 years age group.

In the study percentages of infections is more in 11-20 and 41-50> years age groups, because at that stage children are more exposed to environment, and percentage of infections was high in old age persons are due to low immune response. Similar result has been found by [Ali et al. \(2013\)](#) at district Charsada, adolescence 11-20 years were more infected (22.8%) than younger (1-10 years) and old aged above thirty years were highly (39%) infected.

Seasonal variations were also observed in Khyber Pakhtunkhwa, Pakistan. In the present study high percentage of infection was observed in August (72.56%)

and September (68.52%) and lowest in December (7.93%) and February (12.62%). While, [Yasinzai and Kakar \(2012\)](#) observed high percentage of infection was in May (56.8%) and lowest in June (35.2%) in Jaffarabad. High percentage of infections (57.90%) in September and lowest (25.33%) in January detected by [Mohammad and Hussain \(2003\)](#) in Buner district. The differences in the above mentioned studies are due to number of samples, hygienic conditions of the areas, immune response and temperature of the areas etc.

Conclusion

It was concluded that there were significant risk factors for malaria prevalence. The poor hygienic condition, no use of antimalarials sprays, use of irrigated land, sharing the house with livestock, improper diagnosis, high temperature of the area and load shading also play a key role for the spread of malaria in both Southern and Northern belt of Khyber Pakhtunkhwa, Pakistan.

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Statement of conflict of interest

Author has declared that no competing interests exist.

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