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Prevalence of Malaria in Local Population of District Kohat, Khyber Pakhtunkhwa, Pakistan

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Abstract: Malaria has been one of the leading public health concerns worldwide particularly in developing countries. This study was aimed to determine malarial prevalence in local population of district Kohat in Khyber Pakhthunkhwa province of Pakistan, within the study tenure of three months (April to June). Total 560 blood samples from suspected individuals were collected. These samples were then subjected to microscopic detection of *Plasmodium* by developing thin and thick blood smears followed by giemsa staining. Among all collected samples, only 137 (24.46%) samples were positive for malaria. Further investigation showed that out of positive samples, 129 persons (94.16%) were infected with *Plasmodium vivax* while remaining 8 persons (5.84%) were infected with *Plasmodium falciparum*. Highest number of infected-ratio (35.77%) belonged to the age group "11-20 years", while least prevalence (2.19%) was found in age group "51 years and above". Malarial infection ratio was higher in males 54.74% compared to females 45.26%. It has been concluded from the study that the malarial prevalence is high in Kohat, which may be due to the availability of favorable breeding places for malarial parasites and lack of effective preventive measures in study area.
Key words: Malaria, *Palsmodium falciparum*, *Plasmodium vivax*, Kohat District, Epidemiology

Introduction

Malaria is one of the eminent health concerns; also known as "King of Diseases" caused by an intra-erythrocytic parasite of the genus *Plasmodium*. It lives its life in two hosts; mosquitoes and human. Since malaria has been recognized, about 1 million people worldwide including children and youngsters die every year due to this fatal disease (Snow et al., 2005).

According to World Malaria Report (2011), 21.6 million cases of malaria were reported in 2010 which proved fatal for 655 thousand patients. Worldwide studies of malaria have been focusing on transmission

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modes and carriers of malarial parasite (Coura et al., 2006). It was studied that the malarial transmission is unstable plus transmission rate increases after rains as well as other factors like geographical level and weather conditions also assist in maximizing transmission of malarial parasites including *Plasmodium falciparum*, *Plasmodium malariae* and *Plasmodium vivax* (Oliveira-Ferreira et al., 2010). The most prevalent type of malarial parasite causing more disastrous effects is *Plasmodium vivax* which was the reason of 83.7% malarial cases reported in 2009 (Oliveira-Ferreira et al., 2010).

According to World Health Organization (WHO), eastern Mediterranean region comprises of twenty two countries, out of which six (including Pakistan) bear 95% of the disease burden (World Malaria Report, 2011). Every year Pakistan faces outbreaks of malaria in post monsoon seasons resulting in loss of many precious lives, which can be minimized by prompt diagnosis and implementation of correct treatment (Nizamani et al., 2006). Pakistan initiated "malaria control program" in 1950s (DGHS-NWFP, 2006). Sooner in 1960s, this program was named as "malaria eradication program" however, the name was renamed as "control" instead of "eradication"due to revitalization in 1970s (Nishtar, 2006). In 2004, reported annual parasite incidence of malaria in Pakistan was 5.6% and *plasmodium falciparum* ratio was 33%. (Nizamani et al., 2006). Rural Sindh, Balochistan and Khyber Pakhtunkhwa are the areas having major disease burden in Pakistan and severe malaria is well known cause of morbidity as well as mortality in these regions (Hozhabriet al., 2000).

Anopheles mosquitoes are involved in transmission of malarial parasite (Guerra et al., 2008) which after its bite, transfers malarial parasite into human blood. Through the blood stream, this parasite enters the liver cells as well as red blood cells (RBCs) (Levinson, 2008). Persons infected with malaria show similar symptoms like other bacterial, viral or parasitic infections (Krause et al., 2007). However, malaria shows a cycle of symptoms which occur due to the life cycle of *Plasmodium* in which this parasite invades and reproduce in human liver and blood cells (Eneanya, 1998). Malarial symptoms usually include high fever, muscle and/or back pain while in rare cases, dry cough, loss of conscious and seizures. Impaired spinal cord or brain-function has also been observed, but these symptoms may not always arise due to malaria. Therefore, it is mandatory to confirm the cause of symptoms with the help of advanced diagnostic facilities (Krause et al., 2007).

In Pakistan, malaria is commonly diagnosed through microscopic examination of blood smear (Pinto et al., 1999) and the most commonly found *Plasmodium* species from patient's blood are *P. falciparum* and *P. vivax* (Murtaza et al., 2004). As microscopic detection-method not only requires expertise but also a time-consuming and laborious practice (Chayani et al., 2004). So, developing an efficient, rapid and cost-effective method for malarial detection has always been a major goal in diagnostics of malaria (Vakharia et al., 1997). Although much of the literature is dedicated to find the prevalence of malaria in various parts of Pakistan, however, this study was aimed to provide latest and significant information about the prevalence of malaria endemic in district Kohat. Further, it was also aimed to study age-wise as well as gender-wise distribution of the disease in local population. Under-practice diagnostic methods and management practices for the disease control in district kohat have also been discussed.

Material and Methods

This study was conducted in the months of April to June, 2015. Total 560

blood samples from malarial patients were collected from two hospitals of district kohat located in Khyber Pakhtunkhwa province of Pakistan. These hospitals included District Head-Quarter Hospital and Liaqat Memorial Hospital.

This study was conducted in microbiology laboratories of respective hospitals where sampling was performed. Blood smears were prepared on glass slide followed by giemsa staining with commercially available giemsa stain. The stained slides were viewed under microscope at x40 by x100 accordingly (Muhammad and Hussain, 2003) for the detection of malarial parasite (*Plasmodium sp.*). The positive samples were also examined for morphological identification of specie among *Plasmodium vivax* and/or *Plasmodium falciparum* using the key defined by Clendennen and colleagues (1995).

Results

From total 560 samples, 137 (24.46%) were found malaria positive. Highest number of positive samples was observed in age group 01-10 years with 35.77% (49 samples) followed by 11-20 years (32.84%), 21-30 years (15.33%), 31-40 years (9.49%) and 41-50 years (4.38%) while least ratio was observed in age group above 51years (2.19%), as shown in Figure 1.

It was also observed that the more dominant *Plasmodium* specie identified in the current study was *P. vivax* found in 129 samples (94.16%) followed by *P. falciparum* (5.84%) and no cases of mixed infection was identified. Malaria was detected at high number in males (54.74%) than in females (45.26%). Detailed information about the samples and their identified causative agents along with age-wise distribution is shown in Table 1. Additionally, malarial parasites were detected more in June (39.30%) followed by May (20.10%) and April (6.33%) as shown in Table 2.

Discussion

Malarial disease is well studied and a big problem especially in the developing countries including Pakistan, where it having high morbidity and mortality rate. Malaria affects an estimated 300 million people worldwide causing more than a million death per year. Disease is more severe in children, young women and also in non-immune people (Muhammad and Hussain, 2003).

Pakistan bear loads of stagnant water after rain fall every year, which provide an ideal environment for mosquito breeding. Presence of malaria remain through the year but more intense in summer season (Muhammad and Hussain, 2003). One of the best management practices for initial control of the diseases include eradication of such stagnant waters or treating them chemically to cease reproduction of mosquitoes.

In our study 560 patient were screen out for the microscopic examination of malaria the patient have sign and symptom of malaria recommended by the doctor. Out of the total 560 patient 137 (24.46%) were positive. Out of 137 malarial patients, 129 (94.16%) were infected with *P. vivax* while *P. falciparum* was found in eight patients (5.84%). As previous study of (Muhammad and Hussain, 2003) the total patients examined were 606 in which 43 were positive. In 43 positive patient 36 were *P. vivax* and 7 were *P. falciparum*. It confirms that there is high rate of *P. vivax* as compare to *P. falciparum*.

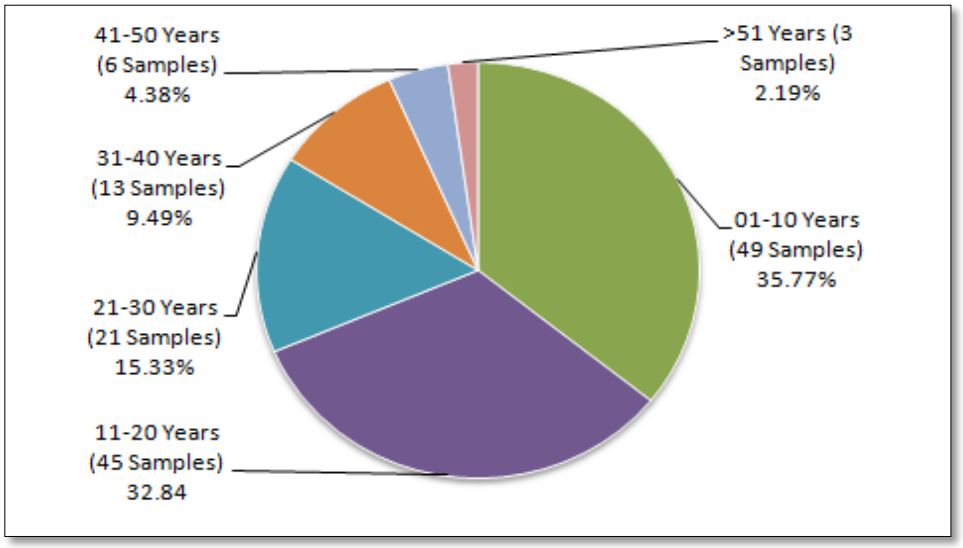

Figure 1. Age-Wise Distribution of 137 malaria-positive samples out of total 560 samples from district kohat

Table 1. Detailed information of identified malaria positive samples

Age Group (Years)	Samples Collected	Male Samples	Female Samples	Malarial Positive						**Total Positive Samples**	**Positive Samples % age**
				Male			Female				
				P. vivax	*P. falciparum*	% age	*P. vivax*	*P. falciparum*	% age		
01 to 10	173	86	87	24	2	18.97	22	1	16.79	**49**	**35.77**
11 to 20	130	65	65	22	2	17.52	21	0	15.33	**45**	**32.84**
21 to 30	83	40	43	11	0	8.03	9	1	7.30	**21**	**15.33**
31 to 40	72	37	35	8	1	6.57	4	0	2.92	**13**	**9.49**
41 to 50	57	28	29	2	1	2.19	3	0	2.19	**6**	**4.38**
>51	45	24	21	2	0	1.46	1	0	0.73	**3**	**2.19**
Total	**560**	**280**	**280**	**69**	**6**	**54.74**	**60**	**2**	**45.26**	**137**	**24.46**

Table 2. Month-wise distribution of samples

Month	**Samples Collected**	**Male**			**Female**			**Positive Samples**	**% age**
		Samples	*P. vivax*	*P. falciparum*	**Samples**	*P. vivax*	*P. falciparum*		
April	142	63	4	0	79	5	0	9	**6.33**
May	189	99	19	2	90	15	2	38	**20.10**
June	229	118	46	4	111	40	0	90	**39.30**
Total	**560**	**280**	**69**	**6**	**280**	**60**	**2**	**137**	**24.5**

In total 560 patients 280 were male and 280 were female. In male 75 were positive out of 280 patients in which 69 were *P. vivax* and 6 were *P. falciparum*.

While in female 62 were positive out of 280 patients in which 60 were *P. vivax* and 2 were *P. falciparum*. The disease is reported more in male. The disease was observed more in males than in females which may be due to under reporting in females because of varied access to health care services and exposure to mosquitoes.

The month wise distribution of parasite infection was found highest in the month of June with an incidence of (39.30%) and the lowest rate parasite infection was found in the month of April (6.33%) where as the 2nd lowest rate parasite infection was in month of May (20.10%). Although malaria is not associated with the month but the climate conditions of a month affects the prevalence of malaria. In June, the focused study area faces harsh and hot season in Pakistan. Our study is in line of (Muhammad and Hussain, 2003) as he observed the month wise distribution on parasite infection was highest in the month of August with an incidence of (11.66%) the lowest rate parasite infection was found in the month of March which was noted to be (3.98%) whereas 2nd lowest rate of infection was (4.6%) was in the month of June.

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