Malaria prevalence in district Okara, Punjab, Pakistan

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ABSTRACT

The present study was conducted to find out the prevalence of malaria in human population of selected four villages of district Okara, province Punjab, Pakistan. Malaria is endemic from the last few years in this area. Blood samples were collected by passive case detection method from four private clinics and a major Basic Health Unit (BHU). Prevalence was determined using slide positivity rate (SPR) across various variables such as village residence, season, age and gender. Blood samples analysis indicated 26% malarial prevalence, out of which 18% cases were male positive and 8% were female positive. Children were more susceptible (43%) as compared to adults (22%) as revealed by passive case detection (PCD) screening for malaria. In general prevalence of malaria was greater in August (41%) as compared to June (22%) and July (23%). Infection with Plasmodium vivax was more predominant (98%) as compared to P. falciparum (2%). Current study indicated that malaria prevalence in selected villages of district Okara was 13 times more as compared to data from various regions of province Punjab.

Key words: Prevalence, Malaria, Okara, Pakistan, Slide positivity rate

INTRODUCTION

Malaria is one of the most prevalent diseases throughout the tropical and most of the sub-tropical areas of the world. WHO estimates that it is endemic in 104 countries (WHO, 2012) where more than three billion population living under threat of malaria. More than 200 million cases are reported each year throughout the world with almost one million deaths mostly among children (WHO, 2011). Gradual escalation of death rate from malaria involves different factors. However, lack of vigilance and adequate resources for its control are among major factors in many countries including Pakistan. The disease is widespread in rural as well as urban areas of Pakistan (Reisen & Milby, 1986). Global malaria situation is steadily rising and its economic cost is also enormous causing heavy annual economic losses (Gallup & Sachs, 2001; Goodman et al., 1999) for developing countries particularly (Brinkmann & Brinkmann, 1991).

Emerging evidences suggest that malaria is the foremost health problem for the population of South-East Asian (SEA) countries. Only Africa accounts for 90% of entire global malaria deaths and from remaining 10%, seventy percent deaths are reported in SEA region. Pakistan is considered to have medium level of malaria occurrence as about 50,000 deaths out of approximately 500,000 reported annual malaria cases. Recent data from Pakistan indicated that P. vivax has a higher prevalence. Falciparum malaria is responsible for about one million deaths annually (WHO, 2012).

Longevity of P. vivax in human host is more than that of P. falciparum, consequently disturbing health slowly (Kreier, 1980).

Many factors have significant effect on transmission of malarial parasite, however, heavy rainfall was found to initiate epidemics of malaria (Himeidan et al., 2007). Different climatic changes show different patterns of disease development in terms of incidence and prevalence. Malaria was found throughout the year however, it was clearly seasonal with epidemic outbreaks in the wet season from June to August (Lee et al., 2003). In Pakistan there is an increase in incidence of falciparum malaria during the last decade which is probably due to the role of climatic changes (Bouma et al., 1996). Temperature affects developmental stages of Plasmodium parasites and mosquito vectors. The extrinsic incubation period (EIP) is reliant on environmental temperature and species of Plasmodium involve in malaria (Pampana, 1969). EIP usually varies from 9 to 10 days however, sometimes can be as brief as 5 days with increase in temperature (Bradley, 1987). P. falciparum and P. vivax have the shortest duration of intrinsic incubation period and therefore, outnumber P. ovale and P. malariae in prevalence (Oaks et al., 1991).

The prevalence of malarial parasites in the human population of urban areas of district Quetta, Pakistan was reported by Kakarsulemankhel & Yasinzai (2004). P. falciparum had a higher incidence (16.31%) among the 21 years and above age groups in this report. In province Khyber Pakhtoon Khaw 88.75% patients were suffering from P. vivax and 7.5% from P. falciparum during...
In a study of four and half years from Karachi, *P. vivax* was most prevalent (51.8%) as compared to *P. falciparum* (46.5%) while *P. malariae* was found least common (0.4%) (Beg et al., 2008). In city of Multan, province Punjab, prevalence of *P. vivax* was also more (3.17%) than *P. falciparum* (1.19%), with aged group 1-5 years having highest prevalence in males (5.55%) than females (3.17%) (Tasawar et al., 2003). A study of malaria prevalence in different age groups of Afghan refugees of Karachi and adjoining native population revealed that malaria was also prevalent in later age groups of Afghan refugees, while disease was restricted to younger age groups of native population (Suleman, 1988).

Malaria is one of the most important vector-borne diseases in Pakistan having major annual burden and still threatening millions of people due to the lack of satisfactory control measures (Pervez & Shah, 1989). Malaria is endemic in many rural areas with moderate prevalence and incidence in tehsil Depalpur, district Okara. An outbreak of falciparum malaria occurred in 2002 and it has become cause of many deaths in Havellakha of this district (unpublished data). The objective of this study was to find out the prevalence of malaria and involvement of *Plasmodium spp.* by passive case detection (PCD) in peak transmission season from selected villages of tehsil Depalpur.

**MATERIALS AND METHODS**

**Study area**

Depalpur belongs to district Okara (31°N and 74°E) in province Punjab, Pakistan with a total land area of 4,377 Km² and a population of more than 15 millions. Climatic conditions of the district are seasonal. The summer season ranges from April to October. May to July are the hottest months. The winter season lasts from November to March. December to February are the coldest months. The annual rainfall of the district is about 11 inches and July to September is rainy season. The region under study was a flat, irrigated, cultivated land, with rice and wheat as the leading crops, during peak malaria transmission months (July to November). It is estimated that rice crop is sown in 278,000 acres area and tube-well and canal system is used for irrigation purposes. The small water bodies developed during rainy season and flooded rice-fields provide breeding sites for Anopheline mosquitoes.

Four selected villages (Bahripur, Balesingh, Amlimoti, Godara) of tehsil Depalpur are located on Pakpattan road, 152 km south west of Lahore. Total population of these villages is 13584 (Bahripur 3220, Balesingh 3611, Amlimoti 4851, Godara 1902). House courtyards were built by mud and bricks mostly. Villagers usually provide different kinds of hosts and resting sites in their houses by keeping cattle and other domestic animals in courtyards. In this area malaria is endemic with seasonal fluctuations and moderate prevalence but severely lacks authentic record. In 2002, an outbreak of falciparum malaria following deaths occurred in tehsil Depalpur. The study will be useful to detect changes in trends or distribution of malaria and will also be helpful for measuring the effectiveness of anti-malaria program.

**Preparation of blood smears for SPR**

The Blood samples were collected twice a month from June to August 2007 (peak transmission season) by PCD from four private clinics and a major Basic Health Unit (BHU) located near village Amlimoti related to the selected villages. Blood smears were formed at the time of sampling. The second or third finger of the left hand of patient (suspected for malaria) was held and cleaned with swab, dipped in spirit and allowed to dry. By pricking the tip of a finger with a sterile disposable needle, two (large and small) drops of blood were placed on the same slide about 10 mm away from one another. The larger drop (3.0 to 4.0 µl) for thick smear was spread with the corner of another slide to form an approximate circle while the smaller drop (1.0 to 1.5 µl) for thin smear was spread by a second slide (the spreader) having a very smooth edge (Rickman et al., 1966). Slide numbers were marked and handled with care, only held by their edges. The thin smears were fixed by immersing slide in methanol for 15-30 seconds and stained by 10% Giemsa. Then slides were flushed with tap water, blotted dried and examined under oil immersion (100x).

**Data analysis**

Malaria prevalence was expressed as percentage of SPR in all villages. Occurrence of this disease was estimated across different variables such as village residence, season, age and gender. Percent SPR was calculated as number of blood smears found positive for malarial parasite/number of blood smears examined × 100. Monthly Blood smears Examination Rate (MBER) was calculated as number of blood smears collected during the month/population covered under surveillance × 100 (WHO, 2013).
RESULTS

In current study total 116 blood samples were collected (June- August 2007) by PCD method from private clinics and a BHU related to four selected villages of district Depalpur. Out of which 30 were positive by SPR showing an average of 26% malaria prevalence in all four villages. Prevalence was greater in Amlimoti (36%) followed by Balesingh (24%), Bahripur (20%) and Godara (19%). The results in the last three villages (except Amlimoti) were not significantly different P>0.05 (Figure 1A). Monthly data recorded as percent prevalence was higher in August (41%) than July (23%) and June (22%). Similarly monthly blood examination rate (MBER) was high in August (0.09%) as compare to July (0.07%) and June (0.06%) (Figure 1B).

Different stages of Plasmodium seen in slides are shown in Figure 2. Prevalence with respect to gender distribution indicated 18% positive cases in males and 8% positive in females, indicating that males were more susceptible for malaria as compared to females. In children (1-10 years), prevalence of malaria was significantly higher (43%) than adults (22%) (10-70 years) (Figure 3).

DISCUSSION

The malaria indicators to track progress towards achieving target of halt spread of malaria by 2015 and goal to combat malaria and other different diseases of Millennium Development Goals (MDGs) include prevalence and mortality ratio related with malaria. Demographic survey in 2001 indicated that the malaria accounts for 0.5% deaths in Pakistan while data on prevalence is negligible in most of the areas of Pakistan. No study to date addresses the prevalence of malaria in Depalpur. Our study indicated an average of 26% prevalence of malaria with respect to SPR from June to August 2007 in all four villages. Total 98% malaria cases in selected area were due to *P. vivax* while 2% were recorded by *P. falciparum*.

In Pakistan as per SPR detection, malaria was reduced from 15% to <0.01% from 1961 to 1967. Then the disease reappeared in 1967 in the country and outbreak arose from 1972 to 1973 having 20% SPR each year in the Punjab province (De Zulueta et al., 1980). Munir et al. (1994) indicated long-term decline in SPR from 14.1% to 3.9% (1973 to 1994) in a report of national malaria statistics. Rowland et al. (2002) documented that malaria prevalence in Punjab province remained almost same with 2% SPR in 1980s and 1990s estimated by annual SPR at district level overtime. Current study indicated that malaria prevalence in selected villages was 13 times more as compared to data from all the Punjab. This could be due to the evaluation of prevalence by only PCD method.

Hozhabri et al. (2000) reported that prevalence of malaria by SPR was 5.9% in children of Jhangara town, Sindh, Pakistan, among which 65% was due to *P. falciparum* and 35% *P. vivax*. In current study prevalence was 43% in children and 22% in adults, indicating higher susceptibility in children than adults. In a case study of 160 children from a private clinic in Mansehra, 154 cases of malaria were confirmed positive during 1999-2004, which also indicated higher susceptibility of malaria in children (96%). The author also reported *P. vivax* was more prevalent (92%) as compared to *P. falciparum* (8%). In addition positive cases were more in male children (71%) as compared to female (29%) (Jalal Ud et al., 2006). Similar findings were observed in present study with respect to gender, 18% were male positive and 7.75% were female positive. Therefore, current findings are comparable with the study reported in Mansehra, Pakistan. More susceptibility of males over females may be due to more exposure to mosquito bites in males. In addition there could be some other physiological factors to attract the mosquitoes.

In conclusion 26% malaria prevalence was found in all selected villages. The prevalence was 43% in children (1-10 years) and 22% in adults (10-70 years) indicating that children were 2x more susceptible than adults. Moreover, susceptibility of males was recorded more (18%) as compared to females (7.75%).

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REFERENCES


Fig., 1: Percent prevalence of malaria using Slide Positivity Rate (SPR) by Passive Case Detection (PCD) (A) Prevalence in selected villages (B) Prevalence and MBER in selected months. Bars representing standard error of the mean (SEM). * showing that values are not significantly different at \( p > 0.05 \).

Fig., 2: Different stages of \( P. \text{vivax} \) seen in slides. (A) S-Schizont (B) G-Gametocyte

Fig., 3: Distribution of malaria cases expressed as percentage among gender and age groups. Bars representing standard error of the mean (SEM).