

# Prevalence of *Plasmodium* spp. in Gulshan-e-Iqbal, Sindh, Pakistan

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## ABSTRACT

**Background:** Malaria is caused by malaria parasite of Genus *Plasmodium*. It is transmitted by the bite of an infected *Anopheles* mosquito. Four species of *Plasmodium* namely *P. malariae*, *P. falciparum*, *P. vivax* and *P. ovale* are responsible for causing malaria in humans. The fifth one, *P. knowlesi* is responsible to cause zoonotic infection in humans. Severe malaria may lead to death in humans.

**Objectives:** To study the prevalence of *Plasmodium* spp. and to evaluate the percentage of infection in males, females and children of Gulshan-e-Iqbal, Karachi, Sindh, Pakistan.

**Methodology:** Samples were collected from different laboratories and hospitals of Gulshan-e-Iqbal, Karachi, Sindh, Pakistan. Chi-square test for frequency data was performed.

**Results:** A total of 411 cases were found to be positive out of 2096 suspected cases. *P. vivax* was more prevalent than *P. falciparum*. Out of 411 patients, 296 cases were of *P. vivax*, 112 were of *P. falciparum*, 2 were of *P. malariae* while one was of *P. ovale*. The frequency of different species was found to be highly significant ( $p < 0.001$ ). In age class <1-15 yrs, 16-40 yrs and 41->80 yrs the frequency differed significantly as indicated by chi-square test ( $p < 0.001$ ). Our results show that infection of malaria is more frequent in males as compared to females.

**Conclusion:** Present survey shall be beneficial for the control of *Plasmodium* infection. Screening of patients who have malaria is important in other areas of Karachi as well. Additional studies with large sample sizes in other localities are required to fully understand malaria pathology in detail. The presence of *P. ovale* and *P. malariae* could be due to travel of subjects to African countries or Sri Lanka.

### Keywords

Malaria, *Plasmodium* spp., Gulshan-e-Iqbal, Karachi, Pakistan.

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## INTRODUCTION

Malaria parasite (Genus *Plasmodium*) is a single celled microorganism which in human population inflicts huge burden in terms of complications leading to sudden unexplained death<sup>1</sup>. *Plasmodium* has many species out of which four species are responsible for inflicting humans (causing malaria) namely *Plasmodium falciparum*, *P.*

*malariae*, *P. ovale* and *P. vivax* while the fifth one *P. knowlesi* causes zoonotic infection in humans<sup>2</sup>. The death rate due to malaria ranges between 1.5 and 2.7 million deaths each year<sup>3</sup>. It is endemic in 109 countries and widespread in the tropics and sub-tropics<sup>4</sup>. In Africa, Papua, New Guinea and Haiti *P. falciparum* is the most

common species while in parts of S. America, Middle East, North Africa and Indian subcontinent *P. vivax* endemic. In Pakistan it is a big public health problem as both *P. vivax* and *P. falciparum* occur simultaneously. Poor sanitation, drug resistance, climate change and improper development activities are the main causes of spread of malaria<sup>5</sup>. In a previous study from Agha Khan University Hospital from 1997 to 2001 it was observed that percentage of *P. vivax* was 51.8 while that of *P. falciparum* was 46.5 with 1.5-2% mortality<sup>6</sup>. Almost ninety five million people here live in areas with high malaria incidence<sup>7</sup>. Cerebral malaria may cause sudden death, it is common when *P. falciparum* infects an individual. Sequestration of infected RBC within cerebral vessels is an important pathological reason of this disease. In places with endemic malaria patients with delirium and malaria must have at least three negative blood smears 8-12 days apart with microscopy in order to be considered fully recovered, although PCR test has shown to be more excessively affected than microscopy but does not provide any information of parasite load and is very expensive<sup>8,9</sup>. In the present study in Gulshan-e-Iqbal, Karachi 411 infected cases were studied for the type of *Plasmodium* infection besides infection rate in three different age groups <1-15, 16-40, 41->80, both male and female individuals was recorded.

## MATERIALS AND METHODS

A cross-sectional survey was carried out in Karachi to determine the prevalence of *Plasmodium* spp. targeting population in Gulshan-e-Iqbal, Karachi.

A total of 411 cases were considered in this study out of 2096 suspected cases from Gulshan-e-Iqbal, Karachi, Sindh, Pakistan. Gulshan-e-Iqbal is in district east of Karachi, most of its population is working class having residential and commercial neighbourhood.

The clinics and hospitals visited were namely DarulSehat hospital, LNH Laboratory Service, Dow University of Health Sciences, Sindlab Clinical Laboratory, Chughtai Laboratory, Ibn-e-Sena hospital, Dr. Essa Laboratory and Patel hospital over a period of 1 year from February 2019 to January 2020. The patients name, sex, age, details of clinical examination findings, antimalarial treatment if previously taken, history of blood transfusion were recorded in requisition form. After acquiring consents, 3

ml of blood specimen were collected from the antecubital vein from all the patients by using disposable syringe. Both thick and thin smears were prepared. The remaining blood was stored in a deep freezer at each laboratory (-8±2°F).

The thick smear was dehaemoglobinized, slide stained with Leishmans stain. After fully drying the slides were observed under oil-immersion lens of microscope in Parasitology Section, Department of Zoology, University of Karachi. If at least one asexual form of parasite was detected in 100 microscopic field in thick film it was considered positive otherwise the report was termed negative. While the thin blood smears were thoroughly examined for malarial parasite. In positive cases the *Plasmodium* spp. was identified by a well trained parasitologist. The study was approved by the Chairperson of Parasitology section, Department of Zoology, University of Karachi, Pakistan. Chi-square test for frequency data was performed<sup>10</sup>.

## RESULTS

A total of 411 cases were found to be positive out of 2096 suspected cases. Four species of *Plasmodium* were identified. *P. vivax* was more prevalent than *P. falciparum*. Out of 411 patients, 296 cases were of *P. vivax*, 112 were of *P. falciparum*, 2 were of *P. malariae* while one was of *P. ovale*.

Maximum number of cases 191 (46.47%) were observed in the age group 16-40 years, 123 (29.92%) in 1-15 years and 97 (23.61%) in the age group 41-80 years. The overall number of infection in the males was 246 out of which 175 (59.13%) were *P. vivax*, 69 (61.61%) were *P. falciparum*, one was *P. malariae* and one was *P. ovale*. The overall number of infection in the females was 165 out of which 121 (40.87%) were *P. vivax*, 43 (38.39%) were *P. falciparum* and 1 was *P. malariae*.

The frequency of type of malaria namely *Plasmodium ovale*, *P. malariae*, *P. vivax* and *P. falciparum* was found to be highly significantly different as disclosed by chi-square test (chi-square=504.1, df=3, p<0.001) (Table 1).

With respect to age classes <1-15 yrs, 16-40 yrs and 41->80 years of patients (malaria cases) the frequency differed significantly as indicated by chi-square test (chi-square=80.2, df=2, p<0.001) (Table 2).

**Table 1. Number of male and female infection of different species of *Plasmodium* in Gulshan-e-Iqbal, Karachi.**

| Total cases | Gender |        | <i>P. vivax</i> |      |        | <i>P. falciparum</i> |      |        | <i>P. malariae</i> |      |        | <i>P. ovale</i> |      |        |
|-------------|--------|--------|-----------------|------|--------|----------------------|------|--------|--------------------|------|--------|-----------------|------|--------|
|             | Male   | Female | Total           | Male | Female | Total                | Male | Female | Total              | Male | Female | Total           | Male | Female |
| 411         | 246    | 165    | 296             | 175  | 121    | 112                  | 69   | 43     | 2                  | 1    | 1      | 1               | 1    | 0      |

Chi-square=504.1, df=3, p<0.001

**Table 2. Percentage of infection in both male and female of three different age groups.**

| Number of positive cases | Gender | Age group  | Percentage % |
|--------------------------|--------|------------|--------------|
| 123                      | ♂ ♀    | <1-15 yrs  | 29.92        |
| 191                      | ♂ ♀    | 16-40 yrs  | 46.47        |
| 97                       | ♂ ♀    | 41->80 yrs | 23.61        |

Chi-square=80.2, df=2, p<0.001

## DISCUSSION

Malaria is endemic in the province of Sindh, Pakistan. More than five lac cases are reported only from two provinces of Pakistan namely Balochistan and Sindh Province<sup>11</sup>. All four type of malaria namely *Plasmodium ovale*, *P. vivax*, *P. falciparum* and *P. malariae* were found in Gulshan-e-Iqbal, Karachi, Sindh with respect to age classes of malaria patients the frequency differed significantly.

Screening of patients in Karachi revealed the presence of *P. vivax* to be two time higher than *P. falciparum*<sup>12</sup> similar to the study conducted at Ayub Teaching hospital, Abbotabad<sup>13</sup>. One year data from Korangi creek area, Karachi was collected and found among 481 infected individuals 82.32 percent *P. vivax* and 17.6 percent *P. falciparum* infection<sup>5</sup>. In a cross sectional study of Swat of Malakand division and district lower Dir (K.P) both thin and thick films were observed for *Plasmodium* infection. Overall positive percentage was 12%, *P. vivax* (99.07%) and *P. falciparum* (0.92%). No other *Plasmodium* species or mixed infection was recorded. Both chloroquine and Artemether were used for treatment<sup>14</sup>. It was recorded that the infection rate in children (5-15 years) *P. vivax* was more frequent (2.69%) than *P. falciparum* (0.35%) in rural areas of Bannu<sup>15</sup> which was in agreement to the findings where was of the total of 11,353 malaria suspected samples studied by microscopy 1829/11353 (16.11 percent) samples were positive amongst which *P. vivax* was observed in 1825 subjects while *P. falciparum* was recorded only in 4 cases (0.2 percent)<sup>16</sup>. It was stated that in Bangladesh malaria exhibited highly seasonal and

hypodermic transmission in geographic hotspots. Chittagong Hill Tracts remained malaria hotspot for a period of four years examined<sup>17</sup>. It was reported that at Rural Health Center, Sinawan, Muzaffargarh, district Punjab, amongst 10,023 suspected malaria cases 208 were confirmed as *P. falciparum* cases<sup>18</sup>. 135 cases of *P. vivax* and 108 cases of *P. falciparum* amongst 241 cases of children visiting Tertiary care hospital, Karachi was recorded<sup>19</sup>.

It is stated that not more than 20 percent population is availing any Government health facilities and many programmes lack facilities as have no microbiologist/parasitologist to detect occurrence of *Plasmodium* is available<sup>11</sup>. Karachi being the biggest city of Pakistan with half the population of Sindh has very low annual parasite index (API)<sup>20</sup>. It was suggested that chloroquine drug has become ineffective for the treatment of *P. falciparum* in many countries including Aligarh, India due to development of resistance by the parasite which could be due to overexposure to improper therapeutic regimes, over the counter availability of drugs and pressure by improper prescribing practices by private doctors<sup>21</sup>. Forty seven positive patients were recorded for *Plasmodium* out of 210 suspected cases in blood smears. Out of 28, 59.57% were identified as *P. vivax* and the rest 40.43% were *P. falciparum* in district Malakand, Khyber Pakhtunkhwa, Pakistan<sup>22</sup>.

The recommended drug for both *P. falciparum* and *P. vivax* is Artemisinin, other treatments for malaria include chloroquine, quinine, amodiaquine and doxycycline.

## CONCLUSION

Frequency of malaria causing species of *Plasmodium* was observed in total four species including *P. vivax*, *P. falciparum*, *P. malariae* and *P. ovale* in Gulshan-e-Iqbal, Karachi, Sindh, Pakistan. The presence of *P. ovale* and *P. malariae* could be due to travel of subjects to African countries or Srilanka. The frequency of type of malaria and age classes of patients differed as well, so it is suggested that screening of patients who have malaria is important in other areas of Karachi. Additional studies with large sample sizes in other localities are required to fully understand malaria pathology in detail.

## ETHICAL APPROVAL

Ethical approval for cross-sectional survey was obtained from the Chairperson of Parasitology Section, Department of Zoology, University of Karachi.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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None.

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None.

## LIST OF ABBREVIATIONS

|      |                    |
|------|--------------------|
| spp. | Species            |
| ml   | mili liter         |
| %    | Percentage         |
| df   | Degrees of freedom |
| p    | Probability value  |

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