

ORIGINAL ARTICLE

# CHANGING SEASONAL TRENDS OF PLASMODIUM VIVAX AND PLASMODIUM FALCIPARUM MALARIA

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## ABSTRACT

**Objective.** To determine changing trends of plasmodium vivax and plasmodium falciparum in different seasons of the year.

**Material and Methods.** This study was carried out from January 2017 to December 2017 in medical units of Khyber teaching hospital Peshawar, Pakistan. All febrile patients admitted in the ward in year 2017 were included in study. Patients were labeled as malaria when giemsa stain slides revealed trophozoites. The frequency of Vivax and falciparum was determined and statistically analyzed for different seasons of the year.

**Results.** Out of total 115 diagnosed cases of malaria, 20 percent Vivax occur in autumn, 19 percent occur in winter, 29 percent in spring and 32 percent in summer while 33 percent of falciparum occur in autumn, 13 percent in winter, 6 percent in spring and 46 percent in summer. Malaria show significant change in trends in different season of the year in a way that plasmodium falciparum reached highest frequency in autumn and summer and plasmodium vivax is relatively constant throughout the year with slightly more cases in spring and summer.

**Conclusion.** There were significant seasonal changes in trends of malaria in different seasons of the year with plasmodium falciparum peaking in the summer and plasmodium Vivax persisting throughout the year.

**Key words.** Change, Seasonal, Plasmodium vivax, Plasmodium falciparum, Malaria.

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## INTRODUCTION

Malaria is endemic throughout most of the tropics and is a major public health problem in these areas. Number of factors influence prevalence of malaria in endemic areas. Malaria is a major public health problem of Pakistan. 60 percent of Pakistan population live in malaria endemic region<sup>1,2</sup>. After eradication efforts in 1960s malaria surged back to an epidemic level in 1970s<sup>3</sup>. In previous few years an upstroke in malaria can be partially attributed to floods that affected approximately 20 million people in 60 districts<sup>2</sup>. Despite a well-established malaria control program, 500,000 malaria infection and 50,000 malaria attributable death occur each year in Pakistan<sup>4</sup>. With approximately 37 percent of cases occur in regions along the borders of Afghanistan<sup>5</sup>.

Malaria in human is caused by plasmodium falciparum, Vivax, Ovale, Malariae, and Knowlesi<sup>6</sup>. Plasmodium Vivax and Plasmodium falciparum are two prevalent plasmodium species in Pakistan<sup>7</sup>. Malaria is primarily found in province of Khyber Pakhtunkhwa, Baluchistan, Sindh and federally administered tribal areas<sup>8</sup>. Microscopy is the standard diagnostic procedure for malaria although molecular, immunological and serological techniques for diagnosis are now available as well<sup>9</sup>.

Seasonal variations in the incidence of malaria have been reported from different part of the world and have been shown to be significantly associated with high prevalence of inter-current illness like preeclampsia and maternal mortality in malaria endemic zones<sup>10</sup>. In many studies dry and rainy seasons variation has been analyzed<sup>11,12</sup>. Malaria is major public health problem of our country<sup>13</sup>. Aim of the study is find changing trends of plasmodium vivax and plasmodium falciparum malaria in different seasons of the year in Peshawar. The data will be helpful in empiric treatment of malaria in different seasons.

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## MATERIAL AND METHODS

This descriptive cross-sectional study was conducted on admitted patients in medical C unit Khyber teaching hospital Peshawar Pakistan from 1 January 2017 to 31 December 2017. Patients from inpatient department age more than 15 years with intermittent high grade fever were included in the study. Patients having upper respiratory tract infection, lower respiratory tract infection, urinary tract infection and gastroenteritis was excluded from study. Non probability consecutive sampling technique was used. Patients were subjected to thick and thin smear examination by pin prick sampling after informed consent. Slides were stained with giemsa stain and examined by pathologist Khyber teaching hospital laboratory. Patients were labeled as malaria when giemsa stained slides show trophozoites. Standard pro-forma was used for relevant data and analyzed using Microsoft word.

## RESULTS

Out of 115 cases diagnosed as malaria, 25 cases occur in autumn, 20 cases occur in winter, 29 cases occur in spring and 39 cases occur in summer. Frequency of Plasmodium Vivax and Plasmodium falciparum malaria in different months of the year is shown in table 1. Distribution of plasmodium vivax and falciparum in different gender in different month the year is given in table no.2. Overall frequency of malaria is high in female patients in different months of the years. 33% of the patients with vivax malaria were male and 67% were female. Among patients with falciparum malaria 40% were male and 60% were female. Plasmodium falciparum starts in summer and stays till autumn while Plasmodium Vivax occur throughout the year with lowest cases in winter. Season wise distribution of plasmodium Vivax and falciparum is shown in table no.3.

## DISCUSSION

In this study we found changing trends of plasmodium falciparum and Vivax malaria in different season of the year. There is high frequency of falciparum malaria in autumn (33 percent) which continue on increasing till summer (46 percent). Frequency of Vivax malaria is relatively constant throughout the year which is a recent change in trend. The effect of season on Vivax and falciparum is highly significant. Comparing our study with two-year study of frequency variation in the hottest areas of Baluchistan and its part of the same study, showed changing trend of falciparum malaria

in almost similar fashion but Vivax change its trend by becoming prevalent throughout the year. Similarly comparing our study with another study on prevalence of malaria in Islamabad, showed seasonality of falciparum in almost similar fashion but Vivax change its seasonality by becoming more prevalent throughout the year.

Seasonal variation has been studied in many infectious diseases particularly bacterial infections

**Table 1: Frequency of plasmodium vivax and falciparum in different months**

Month	Disease	
	Vivax	Falciparum
September	6 (6%)	2 (13.3%)
October	7 (7%)	1 (6.6%)
November	7 (7%)	2 (13.3%)
December	4 (4%)	1 (6.6%)
January	5 (5%)	1 (6.6%)
February	10 (10%)	0
March	13 (13%)	1 (6.6%)
April	7 (7%)	0
May	9 (9%)	0
June	13 (13%)	1 (6.6%)
July	15 (15%)	3 (20%)
August	4 (4%)	3 (20%)
Total	100	15

**Table 2: Gender wise distribution of species of malaria in different months**

Month	Vivax		Falciparum	
	Male	Female	Male	Female
September	2	4	1	1
October	3	4	1	0
November	3	4	1	0
December	2	2	0	1
January	2	3	0	1
February	2	8	0	1
March	3	10	0	1
April	1	6	0	0
May	5	4	0	0
June	4	9	0	1
July	5	10	2	1
August	1	3	1	2
Total	33(33%)	67(67%)	6(40%)	9(60%)

**Table 3: Season wise distribution of Malaria**

Quarters (seasons)	Disease	
	Vivax	Falciparum
September-November (autumn)	20.2 %	33.2%
December-February (winter)	19.1%	13.2%
March-May (Spring)	29.26%	6.6%
June-August (summer)	32.2%	46.6%

and malaria<sup>14,15</sup>. In many studies dry and rainy season variation of malaria is studied but our study has shown quarterly variation in a year<sup>16</sup>. There are many reasons why certain plasmodium transmission favor specific seasons. Rainfall provide mosquitoes a breeding ground leading to upsurge in malarial cases in rainy season<sup>17</sup>. The association between occurrence of malaria and climatic factors have been found with plasmodium vivax<sup>18</sup>. During investigation of evolution of drug resistant plasmodium falciparum in village in eastern Sudan, it was found that emergence of drug resistant falciparum was cyclical<sup>19</sup>. And this cyclical fluctuation in drug resistance gene in plasmodium falciparum most likely reflect seasonal variation in drug pressure and differences in the fitness of resistant and sensitive parasites<sup>20</sup>. It has been estimated that in countries where p vivax is predominant, over one third of patient presenting with acute p, vivax also harbor cryptic p.falciparum<sup>19</sup>. Precise knowledge of multidimensional nature and changing trends of malaria help the physician and malaria control program authority in eradication of malaria. Reason of changing trends of malaria need to be evaluated and compared with different factors responsible for malaria.

### LIMITATIONS

The major limitation of our study is that it was conducted on admitted patients. There is also lack of generalizability of our data to population with different habitus, whether condition and quality of life.

### CONCLUSION

Changing trends of malaria in different seasons of the year do exist in Pakistan and influenced by many factor. A large multicenter well designed study is needed to explore changing trends of malaria.

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#### **AUTHOR'S CONTRIBUTION**

Following authors have made substantial contributions to the manuscript as under:

- Jamil S:** Concept, Design, critical revision data analysis.  
**Khan S:** Data collection, analysis, interpretation, statistical expertise.  
**Jamil M:** Data analysis, interpretation.  
**Alam I:** Drafting referencing.  
**Ubaid M:** Drafting referencing.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.