

ORIGINAL ARTICLE

SEASONAL VARIATIONS OF *VIVAX* AND *FALCIPARUM* MALARIA:
AN OBSERVATION AT A TERTIARY CARE HOSPITAL

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Background: Malaria is a major public health problem in the malaria endemic zones of the world. Various factors influence the prevalence of malaria. This study was conducted to determine the variation in frequency of *Plasmodium vivax* and *Plasmodium falciparum* malaria in different seasons of the year in Khyber Teaching Hospital, Peshawar. **Methods:** A total of 411 patients were included in the study. All these febrile patients were reported to have trophozoites of either *Plasmodium vivax* or *Plasmodium falciparum* malaria on Giemsa stained thick and thin smears. The frequency of *vivax* and *falciparum* malaria was worked out and statistically analysed for different season of the year. The study was carried out from 2nd Jan 2004 till 31st December 2008. **Results:** Out of total 411 diagnosed malaria cases, total 134 (32.60%) presented in the autumn season (*vivax*=33.58%, and *falciparum*=66.42%), 37 (9%) in winter season (*vivax*=32.4%, and *falciparum*=67.6%), 76 (18.49%) in spring season (*vivax*=93.4% and *falciparum* 6.6%) and 164 (39.90%) in summer season (*vivax*=89.6, and *falciparum*=10.4%). The malaria showed a highly significant pattern in different seasons of the year ($p=0.00$) in a way that *Plasmodium falciparum* malaria reached its highest frequency in autumn and winter seasons while *Plasmodium vivax* malaria reached its peak frequency in spring and summer seasons. **Conclusion:** There was highly significant seasonal variation of *vivax* and *falciparum* malaria. There is arrival of *Plasmodium falciparum* in autumn which peaks in winter followed by arrival of *Plasmodium vivax* in spring till the end of summer.

Keywords: Malaria, Falciparum, Vivax, Peshawar

INTRODUCTION

Malaria is a major public health problem of this country, which threatens millions of people. About half a million malaria cases occur annually in Pakistan with an estimated 50,000 deaths each year.¹ This higher mortality is due to lack of awareness and practice of malaria case management guidelines in severe and complicated *vivax* and *falciparum* malaria. The species endemic in our part of the world are *Plasmodium vivax* and *Plasmodium falciparum*.^{2,3}

Microscopy is the standard diagnostic procedure for malaria although molecular, immunological and serological techniques for diagnosis are now available as well.⁴ Seasonal variations in the incidence of the disease caused by these species have been reported from different parts of the world, and have been shown to be significantly associated with high prevalence of associated illnesses like preeclampsia and maternal mortality in the malaria endemic zones.⁵ In many studies dry and rainy seasons variation has been analysed.⁵⁻⁷ Malaria is a major public health problem in our country.⁸ The importance of knowing seasonal variation of malaria and the aetiological factors of its variation in different seasons is clear from the main objectives of WHO world malaria report 2010 and malERA (malaria eradication research agenda) initiative 2011.^{9,10}

The objective of this study was to point out the seasonal pattern in our patients.

MATERIAL AND METHODS

This cross-sectional observational study was conducted on 411 patients who presented to medical out-patient department of Khyber Teaching Hospital between January 2004 and December 2008 with fever and were diagnosed to be suffering from malaria.

All febrile patients of both genders above age 15 year were subjected to thick and thin smear examination by peripheral pin-prick sampling after informed consent. These slides were stained with Giemsa stain and then examined by a pathologist. A standard Performa was filled with the relevant data and results were tabulated and analysed using SPSS-10.

RESULTS

A total of 411 patients were included in the study. The quarterly (season-wise) frequency pattern of *Plasmodium vivax* and *falciparum* malaria in different seasons of the year was highly significant ($p=0.00$) as shown in Table-1. There is arrival of *Falciparum* in autumn which stays till winter while *Vivax* arrives in spring and stays till summer. Monthly distribution of *Plasmodium vivax* and *falciparum* malaria are shown in Table-2 with significant variation in the disease prevalence ($p=0.000$). The four year data for *vivax* and *falciparum* has been summarised in Figure-1 and 2.

Table-1: Season-wise (quarterly) distribution of malaria

Quarters (Season)	Disease		p-value
	Vivax	Falciparum	
December–February (Winter)	12 32.4%	25 67.6%	0.00
March–May (Spring)	71 93.4%	5 6.6%	
June–August (Summer)	147 89.6%	17 10.4%	
September–November (Autumn)	45 33.6%	89 66.4%	

Table-2: Months-Disease cross tabulation

Month	Disease	
	Vivax [n(%)]	Falciparum [n(%)]
January	8 (2.9)	9 (6.6)
February	2 (0.7)	3 (2.2)
March	12 (4.4)	1 (0.7)
April	22 (8.0)	1 (0.7)
May	37 (13.5)	3 (2.2)
June	56 (20.4)	4 (2.9)
July	52 (18.9)	6 (4.4)
August	39 (14.2)	7 (5.1)
September	21 (7.6)	23 (16.9)
October	17 (6.2)	38 (27.9)
November	7 (2.5)	28 (20.6)
December	2 (0.7)	13 (9.6)

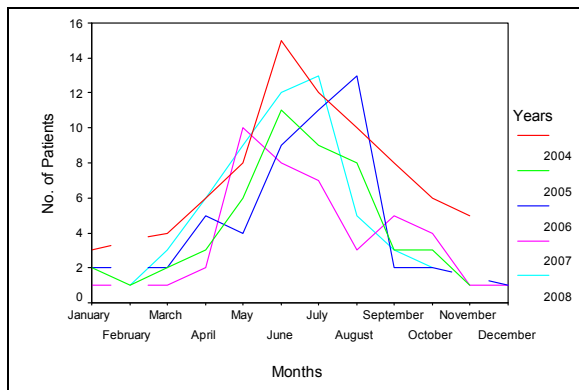


Figure-1: Month wise frequency of Vivax Malaria

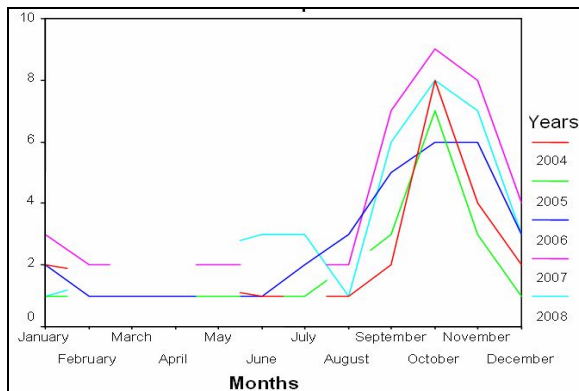


Figure-2: Month-wise frequency of Falciparum Malaria

DISCUSSION

In this cross-sectional observational study of 411 malaria diagnosed cases we found the seasonal frequency variation of *Vivax* and *Falciparum* malaria as

that there is a high frequency of *Falciparum* (66.4%) as compared to *Vivax* malaria (33.6%) in autumn followed by almost same high frequency (67.6%) of *Falciparum* malaria compared to (32.4%) *Vivax* malaria in winter season and vice versa in spring and summer seasons where *Vivax* malaria showed frequencies of 93.4% and 89.6% as compared to 6.6% and 10.4% for *Falciparum* malaria in spring and summer seasons respectively. The effect of the seasons on *Vivax* and *Falciparum* is highly significant ($p=0.000$) Comparing our study with almost similar two year study of frequency variation in the hottest areas of Baluchistan, showed seasonality of malaria in almost similar fashion, i.e., *Falciparum* malaria was common in mid winter and early spring followed by high prevalence of *Vivax* malaria in late spring and summer season.⁶

Seasonal variation has been studied in many infectious diseases particularly bacterial infections and malaria.^{11,12} In many studies dry and rainy seasons have been focused for variation of malaria but our study has shown quarterly variation in a year.¹² There are many reasons why certain *plasmodium* or disease transmission favour specific seasons. Rain fall provides mosquitoes a breeding ground leading to upsurge in the malarial cases during the rainy season.¹² Currently climatic change, behaviour of different vectors and *plasmodium* parasite according to Schmalhausen’s law is under consideration for understanding seasonality of malaria in certain parts of the world.¹³

The association between the occurrence of malaria and Climatic factors, i.e., meteorological and hydrographical factors have been found with *Plasmodium vivax*.¹⁴ During investigation of the evolution of drug-resistant *Plasmodium falciparum* in a village in eastern Sudan, it was found that emergence of drug resistant falciparum was cyclical. And this cyclical fluctuation in drug-resistance genes in *Plasmodium falciparum* most likely reflects seasonal variation in drug pressure and differences in the fitness of resistant and sensitive parasites.¹⁵

Severity, complications (black water fever, cerebral malaria, abortions and algid malaria) and drug resistance of *Falciparum malaria* is affecting millions of our poor people especially the anaemic pregnant ladies of rural areas of our province.¹⁶ Lack of technical staff for diagnosis of malaria and less availability of affective drugs against *Falciparum malaria* has complicated the management.¹⁷ Good knowledge of seasonality and multi dimensional nature of this common illness can help the community, physicians and the malaria control program authority to focus their tools for eradication of malaria.

Whatever the reason of quarterly (seasonal) variation of malaria, it needs to be evaluated and compared with different environmental factors and climate or vector drivers for malaria.

CONCLUSION

Seasonal variation of malaria is present in our part of the world which is influenced by various factors in the environment. A well designed, multi-centre large study is suggested to explore the seasonality of malaria and its drivers in our environment.

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