

Research Article



INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

PROBING THE CLINICAL, LABORATORY, AND SOCIODEMOGRAPHIC FACTORS ASSOCIATED WITH MALARIA: RETROSPECTIVE OBSERVATIONAL STUDY

Dr. Tapish Shivhare,^{1*} Dr. Maya Dawar,² Dr. Subodh Mishra,³ Dr. Swati Jain⁴

^{1*,2}P.G. Resident, Department of Community Medicine, RKDF Medical College Hospital and Research Centre, Bhopal, Madhya Pradesh

³Professor, ⁴Professor & Head, Department of Community Medicine, RKDF Medical College Hospital and Research Centre, Bhopal, Madhya Pradesh

Corresponding Author

Dr. Tapish Shivhare

Email Id -: tapishshivhare@gmail.com

How to cite: Shivhare T, Dawar M, Mishra S, Jain S. Probing the clinical, laboratory, and sociodemographic factors associated with malaria: a case-control study. International Research Journal of Pharmacy, 2025,16:3:11-16.

Doi:10.7897/2230-8407.110503

ABSTRACT

Background: India is a nation where malaria is endemic with risk to the entire population and high malaria case fatality rates. NMEP (National Malaria Elimination Program) has helped reduce the mortality from malaria in India, however, mortality due to malaria related complication remain a concern. there are alarmingly high mortality rates from anemia in certain geographical regions.

Aim: This study aimed to assess the clinical, laboratory, and sociodemographic factors associated with malaria from *P. falciparum* and *P. vivax*.

Methods: The present retrospective record-based clinical study assesses records of subjects admitted to the Institute with malaria in the defined period of the study. The subjects with malaria were further divided into *P. vivax* and *P. falciparum* cases. In all the cases, the clinical, laboratory, and sociodemographic factors were assessed. Data gathered were analyzed statistically.

Results: During the study period, 222 cases of malaria were assessed where 22.52% (n=50) and 77.43% (n=172) cases were due to *P. falciparum* and *P. vivax* respectively. There was no significant difference depicted in the sociodemographic data of *P. vivax* and *P. falciparum* cases. The most common clinical symptoms were similar in *P. vivax* and *P. falciparum* cases. Hepatomegaly was common in *P. falciparum* cases and splenomegaly in *P. vivax* cases. Thrombocytopenia was seen in 58.1% (n=100) and 72% (n=36) subjects with *P. vivax* and *P. falciparum* cases. No significant difference was seen in other laboratory parameters.

Conclusions: Keeping the limitations, the present study concludes that clinical, laboratory, and sociodemographic factors associated with malaria from *P. falciparum* and *P. vivax* have no statistically significant difference.

Keywords: clinical features, laboratory parameters, malaria, *P. falciparum*, *P. vivax*, sociodemographic data

INTRODUCTION

Malaria is a parasitic disease that has a potential to put life at risk condition and is caused by the parasites termed as *Plasmodium ovale*, *Plasmodium malariae*, *Plasmodium falciparum*, and *Plasmodium vivax*. In humans, there are two types of human malarial parasites namely *P. vivax* and *P. falciparum* which are usually reported in Indian subjects affected by malaria.

Malaria is a common concern in India posing a high burden on the healthcare sector in different parts of India. Concerning the Indian context, nearly 95% of the population is resident of areas that are endemic to malaria and 80% of the malaria cases reported in India are from residents of inaccessible, difficult, hilly, and tribal areas.¹

Following WHO (World Health Organization) reports from the years 2011 and 2012, the second largest burden of malaria is attributed to the South East Asia region with a 13% contribution which is only after the African regions that contribute to 81% of the malaria cases. In 13% of South East Asia region burden, two-thirds of the burden is shared by India with 66% contribution followed by 18% burden by Myanmar and 10% by Indonesia.²

Concerning India, the deadliest and most common species causing malaria is *P. falciparum* followed by *P. vivax* where *P. falciparum* contributes to 52% of all malaria cases following the report of 2010. The other two common species are *P. ovale* and *P. malariae* which are after *P. vivax* where *P. malariae* causes <10% of malaria cases and *P. ovale* results in very few malaria cases. Recently, *P. knowlesi*, another plasmodium species has been identified and linked to malaria which usually infects macaques in Southeast and South Asian regions particularly Malaysia with increasing cases in Europe.³

High mortality rates from *P. falciparum* are due to the ability of *P. falciparum* to lead to malaria of high severity in the majority of the cases and multiple organ dysfunction in a few cases. The mortality patterns and presenting symptoms of severe malaria vary largely based on the transmission intensity and geographical settings. Earlier, *P. vivax* was taken as a benign parasite in comparison to *P. falciparum*, recent literature data depicted that subject with severe *P. vivax* and *P. falciparum* depicts similar disease manifestation.⁴

It is vital to assess different factors in cases of malaria owing to *P. vivax* and *P. falciparum* in detail as these are the two most common malaria species seen in India.⁵ Hence, the study presented was at purpose to assess the sociodemographic factors of subjects affected by *P. vivax* and *P. falciparum* species. To probe the clinical profile of malaria cases due to *P. vivax* and *P. falciparum* species. To comparatively judge the laboratory parameters of malaria cases due to *P. vivax* and *P. falciparum* species.

MATERIALS AND METHODS

The present retrospective record-based clinical study presented was at purpose to assess the clinical, laboratory, and sociodemographic factors associated with malaria from *P. falciparum* and *P. vivax*. The participants for the study were from the Outpatient Department of the Institute.

During the duration of this study, 222 admitted patients of malaria were assessed and were presented to the institute following a confirmed diagnosis of malaria. The inclusion criteria for the study were subjects who were admitted to the institute and were diagnosed as having malaria, subjects where complete hospital data and records were available that were needed for the study, and subjects where written consent was available in the records. The exclusion criteria for the study were subjects where the data were incomplete or missing, subjects where informed consent was not available, and diseases that could affect clinical or laboratory data.

After the final inclusion of the study subjects, detailed history, and demographic data were retrieved for all the subjects from the existing institutional records. Also, other relevant data were gathered from the medical records of the Institute for the included confirmed cases of malaria admitted at the Institute. The socio-demographic data gathered were residence, gender, and age of the subjects. All the relevant and vital clinical findings noted in the case proforma were also noted in detail. This was followed by recording and noting all vital laboratory parameters in all the study subjects.

The cases of malaria were then categorized based on the diagnosis into cases of *P. vivax* and cases of *P. falciparum*. The vital laboratory parameters including serum creatinine, serum bilirubin, platelet counts, total leucocyte counts, hemoglobin percentages, any complications, clinical profile including vital signs and symptoms, and sociodemographic data were compared for *P. falciparum* and *P. vivax*.

The data gathered were compared statistically and expressed as proportions and percentage. The test of significance used in the present study was the χ^2 test. The value of p when <0.05 was taken as significant for the statistical concerns.

RESULTS

The present retrospective record-based clinical study was aimed to assess the clinical, laboratory, and sociodemographic factors associated with malaria from *P. falciparum* and *P. vivax*. During the study period, 222 cases of malaria were assessed where 22.52% ($n=50$) and 77.43% ($n=172$) cases were due to *P. falciparum* and *P. vivax* respectively. For sociodemographic

data, there were 110 males and 62 females in *P. vivax* and 36 males and 14 females in the *P. falciparum* group which was the nonsignificant difference with $p=0.614$. There were 26, 36, 54, and 56 subjects in *P. vivax* and 6, 14, 14, and 16 subjects from the *P. falciparum* group respectively from 0-10, 11-20, 21-30, and >31 years of age ($p=0.633$). Urban and rural residents were 92 and 80 from *P. vivax* and 18 and 32 respectively from *P. falciparum* depicting statistical non-significance with $p=0.187$. For weather, winter, monsoon, post-monsoon, and hot weather affected 14, 88, 46, and 24 subjects respectively from *P. vivax* and 2, 22, 20, and 6 cases with *P. falciparum*, ($p=0.822$). Hospitalization duration was 1-5, 6-10, and >10 in 82, 74, and 16 cases respectively of *P. vivax* and 20, 24, and 6 cases of *P. falciparum* respectively (Table 1).

It was seen that for comparison of symptoms occurrence in *P. vivax* and *P. falciparum* study cases, the most common symptom was fever in 95% ($n=194$) and 100% ($n=50$) *P. vivax* and *P. falciparum* cases respectively followed by chills in 86% ($n=158$) and 88% ($n=44$) *P. vivax* and *P. falciparum* cases, vomiting in 24% ($n=42$) and 16% ($n=8$) *P. vivax* and *P. falciparum* cases. Headache in 21% ($n=36$) and 32% ($n=16$) *P. vivax* and *P. falciparum* cases, body ache in 22% ($n=38$) and 32% ($n=16$) *P. vivax* and *P. falciparum* cases, Giddiness in 9% ($n=16$) and 20% ($n=10$) *P. vivax* and *P. falciparum* cases, convulsions in only 8% ($n=4$) *P. falciparum* cases, weakness in 15% ($n=26$) and 12% ($n=6$) *P. vivax* and *P. falciparum* cases, loose motions in 6% ($n=10$) *P. vivax* cases, abdominal pain in 9% ($n=16$) and 8% ($n=4$) *P. vivax* and *P. falciparum* cases, nausea in 10% ($n=18$) and 16% ($n=8$) *P. vivax* and *P. falciparum* cases, dry cough in 15% ($n=26$) and 16% ($n=8$) *P. vivax* and *P. falciparum* cases, and anorexia in 12% ($n=20$) and 4% ($n=2$) *P. vivax* and *P. falciparum* cases respectively (Table 2).

The study results showed that concerning the comparison of signs occurrence in *P. vivax* and *P. falciparum* study cases, hepatomegaly and splenomegaly were seen in 20% ($n=34$) and 4% ($n=2$) *P. vivax* and *P. falciparum* cases respectively, hepatomegaly was seen in 24% ($n=42$) and 12% ($n=6$) *P. vivax* and *P. falciparum* cases respectively, splenomegaly was seen in 33% ($n=56$) and 12% ($n=6$) *P. vivax* and *P. falciparum* cases respectively, and pallor was seen in 65% ($n=112$) and 76% ($n=38$) *P. vivax* and *P. falciparum* cases respectively (Table 3).

Concerning the comparison of laboratory parameters in *P. vivax* and *P. falciparum* study cases, increased serum creatinine levels >1.5 mg/dl were seen in 6.97% ($n=12$) *P. vivax* and 20% ($n=10$) *P. falciparum* cases which were significantly higher. Increased serum bilirubin levels >3 mg/dl were seen in 23.25% ($n=40$) *P. vivax* and significantly higher 32% ($n=16$) *P. falciparum* cases. Platelet counts of <50,000 were seen in 22.09% ($n=38$) *P. vivax* and significantly higher 28% ($n=14$) *P. falciparum* cases, 50,000-100,000 in 32.56% ($n=56$) *P. vivax* and 20% ($n=10$) *P. falciparum* cases, 100,000-150,000 per cmm in 3.495 ($n=6$) *P. vivax* and 24% ($n=12$) *P. falciparum* cases, 150,000-450,000 in 40.70% ($n=70$) *P. vivax* and 28% ($n=14$) *P. falciparum* cases, and >450,000 in 1.16% ($n=2$) *P. vivax* and 0 *P. falciparum* cases respectively. TLC counts of <4000 per cmm were seen in 17.44% ($n=30$) *P. vivax* and 16% ($n=8$) *P. vivax* cases, 4000-10,000 in 72.09% ($n=124$) and 76% ($n=38$) *P. falciparum* cases, and >10,000 were seen in 10.46% ($n=18$) and 8% ($n=4$) *P. vivax* and *P. falciparum* cases respectively. Hemoglobin levels of <5gm% were seen in 12% ($n=6$) *P. falciparum* cases, 5-10 gm% in 37.21% ($n=64$) and 32% ($n=16$) *P. vivax* and *P. falciparum* cases respectively, and >10 gm% in 62.79% ($n=108$) and 56% ($n=28$) *P. vivax* and *P. falciparum* cases respectively (Table 4).

DISCUSSION

The present study retrospectively assessed the laboratory findings, clinical picture, and sociodemographic characteristics in 222 subjects with confirmed clinical diagnosis of malaria, and comparison was done in *P. vivax* and *P. falciparum* cases. During the study period, 222 cases of malaria were assessed where 22.52% ($n=50$) and 74.48% ($n=172$) cases were due to *P. falciparum* and *P. vivax* respectively. These findings were in agreement with the results of Muddiaiah and Prakash in 2006.⁶ In the present study the female-to-male ratio was 1:2 which was also consistent with the study of Muddiaiah and Prakash and the study of Mishra G⁷ in 2003 depicting similar female: male ratio. The high infection rate in the male subjects can be due to high accessibility to medical care and high mobility in males. Also, males are at high environmental exposure and have high risk.

Malaria cases are usually studies concerning seasonal variations with the maximum incidence seen in the present study in the monsoon season from June to September which was similar to the studies of Muddiaiah and Prakash⁶ and the study of Mishra G.⁷ This correlation of increased incidence of malaria and monsoon can be attributed to increase survival of female anopheles and increase in breeding sites owing to increased relative humidity. It was seen here that no difference was reported in *P. vivax* and *P. falciparum* cases concerning hospitalization duration, seasonal variations, and sociodemographic data.

In all the subjects, the most common clinical presenting features were chills and fever along with vomiting, headache, and body aches. Fever was seen in 100% of cases of *P. falciparum*. This was again in line with the studies of Muddiaiah and

Prakash⁶ and study of Mishra G.⁷ The most common sign seen was pallor in 69% of subjects followed by splenomegaly and hepatomegaly in 27% and 22% of subjects respectively in *P. falciparum* cases. In *P. vivax* cases, the most common sign was splenomegaly in 33% of subjects. This can be attributed to the chronic infection and high relapse incidence in *P. vivax* infection. The presence of pallor in 69% of subjects is similar to the study of Taksande et al⁸ in 2006 where authors reported Pallor as the most common sign of malaria.

Hemoglobin levels of <5gm% were seen in 12% (n=6) *P. falciparum* cases, 5-10 gm% in 37.21% (n=64) and 32% (n=16) *P. vivax* and *P. falciparum* cases respectively, and >10 gm% in 62.79% (n=108) and 56% (n=28) *P. vivax* and *P. falciparum* cases respectively. These findings were in contrast with the study of Mohapatra MK⁹ in 2006 where authors reported anemia incidence of 6.9% only in their study. However, another study by Kocher et al¹⁰ in 2004 reported an increase in anemia incidence from 6% to 26%.

TLC counts of <4000 per cmm were seen in 17.44% (n=30) *P. vivax* and 16% (n=8) *P. vivax* cases, 4000-10,000 in 72.09% (n=124) and 76% (n=38) *P. falciparum* cases, and >10,000 were seen in 10.46% (n=18) and 8% (n=4) *P. vivax* and *P. falciparum* cases respectively. This was comparable to the results of Rasheed P et al¹¹ in 2009. Platelet counts of <50,000 were seen in 22.09% (n=38) *P. vivax* and significantly higher 28% (n=14) *P. falciparum* cases, 50,000-100,000 in 32.56% (n=56) *P. vivax* and 20% (n=10) *P. falciparum* cases, 100,000-150,000 per cmm in 3.49% (n=6) *P. vivax* and 24% (n=12) *P. falciparum* cases, 150,000-450,000 in 40.70% (n=70) *P. vivax* and 28% (n=14) *P. falciparum* cases, and >450,000 in 1.16% (n=2) *P. vivax* and 0 *P. falciparum* cases respectively. These results correlated with Rasheed P et al¹¹ in 2009 which reported thrombocytopenia as a common manifestation of malaria. However, low platelet counts are seen with *P. falciparum* when comparison was made with *P. vivax*. In 3.48% (n=6) subjects, cerebral malaria was seen, caused by *P. falciparum* associated with no mortality, and recovered with appropriate treatment.

No statistically significant difference was seen in laboratory parameters and clinical profiles of *P. vivax* and *P. falciparum* cases of malaria. Earlier, *P. vivax* was considered a cause of only benign malaria which rarely caused severe forms of malaria. However, an increase in the evidence has reported an elevated risk associated to morbidity and mortality from *P. vivax* malaria as reported by Kochar DK et al¹⁰ in 2006, Mahagoub H et al¹² in 2012, and Kute VB et al¹³ in 2012.

CONCLUSIONS

Malaria is a vital public and medical healthcare concern in India. In the present study, it is seen that no statistically significant difference is seen in sociodemographic data of malaria cases due to either *P. vivax* or *P. falciparum*. A similar non-significant difference was seen in laboratory parameters and clinical profile of malaria cases by *P. vivax* or *P. falciparum*. Malaria caused by any *Plasmodium* should be managed with priority and critical care. To attain a clearer picture, more research is needed on a larger scale.

REFERENCES

1. Espinoza JL. Malaria resurgence in the Americas: an underestimated threat. *Pathogens*. 2019;8:11. doi: 10.3390/pathogens8010011.
2. WHO Severe Malaria. *Trop Med Int Health*. 2014;19:7–131. doi: 10.1111/tmi.12313_2.
3. Arévalo-Herrera M, Lopez-Perez M, Medina L, Moreno A, Gutierrez JB, Herrera S. Clinical profile of *Plasmodium falciparum* and *Plasmodium vivax* infections in low and unstable malaria transmission settings of Colombia. *Malar J*. 2015;14:154. doi: 10.1186/s12936-015-0678-3.
4. Kulkarni VK, Agrawal K. A study of clinical profile of malaria with special reference to complications and outcome. *Int J Adv Med*. 2017;4:317–322. doi: 10.18203/2349-3933.ijam20171010.
5. Baird JK. Evidence and implications of mortality associated with acute *Plasmodium vivax* Malaria. *Clin Microbiol Rev*. 2013;26:36–57. doi: 10.1128/CMR.00074-12.
6. Muddaiah M, Prakash PS. A study of the clinical profile of malaria in a tertiary referral center in South Canara. *J Vector Borne Dis* 2006;43:29-33. <https://pubmed.ncbi.nlm.nih.gov/16642783/>
7. Mishra G. Hospital-based study of malaria in Ratnagiri district, Maharashtra. *J Vector Borne Dis* 2003;40:109-11. <https://pubmed.ncbi.nlm.nih.gov/15119081/>
8. Taksande A, Vilhekar K, Jain M, Atkari S. Clinico-haematological profile of cerebral Malaria in a Rural hospital. *J Indian Acad Clin Med* 2006;7:308-12. DOI: <https://doi.org/10.26611/10211928>.

9. Mohapatra MK. The natural history of complicated falciparum malaria – A prospective study. J Assoc Physicians India 2006;54:848-53. <https://pubmed.ncbi.nlm.nih.gov/17249251/>
10. Kochar DK, Kochar SK, Agrawal RP, Sabir M, Nayak KC, Agrawal TD, et al. The changing spectrum of severe falciparum malaria: A clinical study from Bikaner (northwest India). J Vector Borne Dis 2006;43:104-8. <https://pubmed.ncbi.nlm.nih.gov/17024858/>
11. Rasheed A, Saeed S, Khan SA. Clinical and laboratory findings in acute malaria caused by various Plasmodium species. J Pak Med Assoc 2009;59:220-3. <https://pubmed.ncbi.nlm.nih.gov/19402282/>
12. Mahgoub H, Gasim GI, Musa IR, Adam I. Severe Plasmodium vivax malaria among Sudanese children at New Halfa Hospital, Eastern Sudan. Parasit Vectors 2012;5:154. doi: 10.1186/1756-3305-5-154.
13. Kute VB, Trivedi HL, Vanikar AV, Shah PR, Gumber MR, Patel HV, et al. Plasmodium vivax malaria-associated acute kidney injury, India, 2010-2011. Emerg Infect Dis 2012;18:842-5. doi: 10.3201/eid1805.111442.

S. No	Factors	P. vivax (n=172)	P. falciparum (n=50)	p-value
1.	Gender			
a)	Males	110	36	0.614
b)	Females	62	14	
2.	Age range (years)			
a)	0-10	26	6	0.633
b)	11-20	36	14	
c)	21-30	54	14	
d)	>31	56	16	
3.	Residence			
a)	Urban	92	18	0.187
b)	Rural	80	32	
4.	Weather			
a)	Winter (Dec-Feb)	14	2	0.822
b)	Monsoon (June-Sept)	88	22	
c)	Post monsoon (Oct-Nov)	46	20	
d)	Hot (March-May)	24	6	
5.	Hospitalization duration			
a)	1-5	82	20	0.797
b)	6-10	74	24	
c)	>10	16	6	

Table 1: Comparison of sociodemographic data in P. vivax and P. falciparum study cases

S. No	Symptoms	P. vivax		P. falciparum	
		n=172	%	n=50	%
1.	Anorexia	20	12	2	4
2.	Dry cough	26	15	8	16
3.	Nausea	18	10	8	16
4.	Abdominal pain	16	9	4	8
5.	Loose motions	10	6	0	0
6.	Weakness	26	15	6	12
7.	Convulsions	0	0	4	8
8.	Giddiness	16	9	10	20
9.	Breathlessness	6	3.48	2	4
10.	Body ache	38	22	16	32
11.	Headache	36	21	16	32
12.	Vomiting	42	24	8	16
13.	Chills	158	86	44	88
14.	Fever	194	95	50	100

Table 2: Comparison of symptoms occurrence in P. vivax and P. falciparum study cases

S. No	Symptoms	P. vivax		P. falciparum	
		n=172	%	n=50	%
1.	Hepatomegaly with splenomegaly	34	20	2	4
2.	Hepatomegaly	42	24	6	12
3.	Splenomegaly	56	33	6	12
4.	Pallor	112	65	38	76

Table 3: Comparison of signs occurrence in P. vivax and P. falciparum study cases

S. No	Symptoms	P. vivax		P. falciparum	
		n=172	%	n=50	%
1.	Seru creatinine (mg/dl)				
a)	Normal (0.5-1.5)	160	93.02	40	80
b)	Increased (>1.5)	12	6.97	10	20
2.	Serum bilirubin (mg/dl)				
a)	Normal (0.2-1)	132	76.74	34	68
b)	Increased (>3)	40	23.25	16	32
3.	Platelet count (per cmm)				
a)	<50,000	38	22.09	14	28
b)	50,000-100,000	56	32.56	10	20
c)	100,000-150,000	6	3.49	12	24
d)	150,000-450,000	70	40.70	14	28
e)	>450,000	2	1.16	0	0
4.	TLC (per cmm)				
a)	<4000	30	17.44	8	16
b)	4000-10,000	124	72.09	38	76
c)	>10,000	18	10.46	4	8
5.	Hemoglobin (g%)				
a)	<5	0	0	6	12
b)	5-10	64	37.21	16	32
c)	>10	108	62.79	28	56

Table 4: Comparison of laboratory parameters in P. vivax and P. falciparum study cases