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A RETROSPECTIVE STUDY ANALYSING THE PREVAILING MALARIA TRENDS IN CHHATTISGARH

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Keywords:

Chhattisgarh, Malaria, *Plasmodium falciparum*, Plasmodium vivax

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ABSTRACT: Introduction: Malaria is a seasonal disease and endemic in Chhattisgarh, as a large number of cases and deaths are reported from the tribal-dominated districts of Chhattisgarh. The distribution of these malaria parasites can vary across different regions of India due to climate, geography, mosquito vector species present, human population dynamics, and socio-economic conditions. **Aims and Objectives:** This study was carried out to analyse the trends in the prevalence of malaria parasites from 2018 to 2022in a tertiary care center. **Materials and Methods:** Retrospective Data from five annual cross-sectional Rapid diagnostic tests for malaria antigen were analysed from a combined sample of 27,844 individuals suspected of malaria. Data collected included demographic profile and test results of malaria parasites by Rapid diagnostic test. **Results:** The overall malaria prevalence rate detected during the study period was 1.39%. *P. falciparum* species showed predominance, with a pinnacle of 96.1% (100) in 2020. Malaria cases were found to be more associated with young adults (31.95%) males (62.88%) with peak positivity rate recorded in month of July to August. **Conclusion:** The present study shows a decline in the number of malaria cases from 2018 to 2022 except in 2020. The cases showed seasonal variation with the most cases reported in the monsoon season. As coordinated efforts from clinicians, laboratory personnel, and community health workers have brought India into a decline phase of malaria, it's important to maintain these interventions to sustain progress and move towards the goal of elimination.

INTRODUCTION: Malaria, a protozoal disease caused by the Plasmodium parasite, is a vector borne disease that is transmitted to humans through the bite of infected female Anopheles mosquitoes. *Plasmodium falciparum* (*P. falciparum*), *Plasmodium vivax* (*P. vivax*), Plasmodium malariae and Plasmodium ovale are the four common species causing infection in humans.

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In India malaria is caused by *Plasmodium falciparum* and *Plasmodium vivax* but *Plasmodium falciparum* is well known for complications and fatal outcomes [1]. The disease can have severe consequences, including fever, chills, flu-like symptoms, anaemia and even death in some cases [2].

According to the World Health Organization (WHO), nearly half of the world's population is at risk of malaria, especially in tropical and sub-tropical countries. It is estimated that about 95% of the Indian population lives in malaria-prone areas. Furthermore, a substantial portion of malaria cases in the country are reported from areas with limited access to healthcare facilities [3]. The National vector born disease control programme (NVBDCP) was

initiated in 2002 to combat vector borne diseases including malaria. Since, then, India has significantly achieved malaria control, leading to a progressive decline in total number of cases and deaths. According to the World Malaria Report 2020, WHO India reported a 20% decline in malaria cases as compared to 2019 [4].

Aims and Objectives: The objective of this study was to analyse prevailing trends of malaria concerning the specification of plasmodium in tertiary care center in the high endemic region of Chhattisgarh.

MATERIALS AND METHODS:

Study Area: This retrospective study was carried out in the Department of Microbiology, BRLSABVM Medical College, Rajnandgaon, Chhattisgarh, where five years; Malaria Antigen detection by Rapid Diagnostic (RDT)data performed from January 2018 to December 2022, were analysed. Ethical approval obtained from the Institute Ethical Committee letter number-71/IEC/BRLSABVMMCRJN/2023, dated 7/7/2023.

Sample size and Inclusion Criteria: All patients, irrespective of age and gender who attended the out-patient department (OPD) with fever and other symptoms suspected of malaria during the study period and underwent Rapid diagnostic test for malaria antigen were evaluated.

Methods: During this period, blood samples were received for malaria diagnosis from clinically suspected cases in EDTA vacutainer tube and Rapid Diagnostic test was performed using Antigen based Plasmodium histidine-rich protein 2 (Pf (HRP-II) and *Plasmodium vivax* lactate dehydrogenase (pLDH) specific kit. The procedure was performed as per manufacturer's instructions. About 5 µl of blood was put in sample well with the help of disposable loop provided with the kit. 4 drops of assay diluent provided with the kit was added to second well. Results were interpreted after 15-20 minutes. Results were interpreted as negative when only control band appeared with two negative test bands and as mixed infection when control band and two test bands appeared. It was interpreted as *Plasmodium vivax* infection when Pv band appeared along with control band. *Plasmodium falciparum* was diagnosed when Pf band and control band appeared and mixed infection was diagnosed when Pv and Pf band appeared along with control band.

Statistical Analysis: Data retrieved from the record included sociodemographic details along with Rapid Diagnostic test for Malaria antigen result, which was entered in Microsoft excel. Categorical variables were analysed by frequency and percentage. The comparisons of proportions between males and females were performed using the chi-square test and p value <0.05 was considered significant.

RESULTS: Out of 27,844 patients suspected of malaria were tested between 2018 to 2022, out of which 388 (1.39%) tested positive for malaria antigen in our laboratory.

Table 1 shows the fluctuating trend in an annual number of malaria cases. In 2018 to 2019 showed 9% fall, whereas 2019 to 2020 showed a rise in 30% followed by 45% fall from 2020 to 2021and again rise of 3.5% from 2021 to 2022. Thus overall, 32.95% fall was observed from 2018-2022.

TABLE 1: ANNUAL DISTRIBUTION OF RDT POSITIVE MALARIA (2018-2022)

Year	Total RDT Tested	Malaria positive cases by RDT	Decrease/ Increase percentage of cases in subsequent year
2018	8439	88	-
2019	10114	80	9% decrease
2020	4263	104	30% increase
2021	2833	57	45% decrease
2022	2195	59	3.5% increase
Total	27,844	388	-

Fig. 1 shows annual distribution of malaria species as *P. falciparum*, *P. vivax* and mixed infection. Throughout the study period *P. falciparum* species were highly prevalent. It is observed that nearly similar status of *P. falciparum* species in 2018 and 2019 as 61.3% (54) and 63.7% (51) respectively.

Maximum impact recorded was 96.1% (100) in 2020 then onward showed decline in number of cases as 89.4% (51) and 79.6% (47) in subsequent years 2021 and 2022. The prevalence related to *P. vivax* was less as compared to *P. falciparum* but showed fluctuating trend throughout the study. 2018, *P. vivax* cases observed was 36.3% (32) followed by decrease in number 2019 as 23.7% (19) followed by a sudden fall to 2.8% (03) and 8.7% (05) in 2020 and 2021. Then again rise in 2022 showing 20.3% [12]. Mixed Infection observed was 2.2% in 2018 followed by a rise in 2019 to 12.5% and steep decline in 2020 less than 1% followed by 1.7% in 2021 and none of the case was detected as mixed infection in 2022.

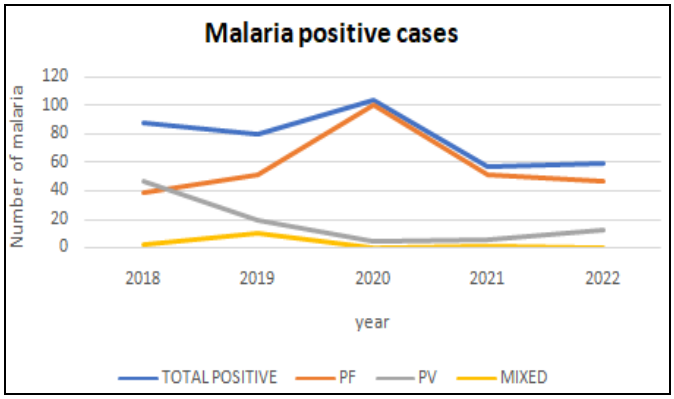

FIG. 1: ANNUAL DISTRIBUTION OF MALARIA SPECIES

In **Fig. 2** Bi-monthly analysis of malaria cases during study period 2018-2022, shows increasing trends from Jan to August followed by decline till December. It signifies maximum cases in July to August, the most sensitive months in India for vector-borne diseases.

During the entire study period trend observed is similar showing highest number of cases in monsoon season (July to August), with 2020 showing maximum cases throughout the year except in Jan-Feb and Sept-Oct month compared to rest of the study period.

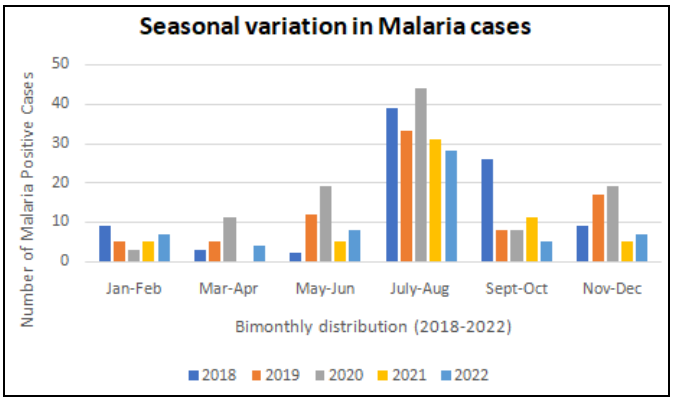

FIG. 2: BI-MONTHLY ANALYSIS OF MALARIA CASES (2018-2022)

As per **Table 2** cases were classified into various age groups, positive cases were found to be highest among 21–30-year age group throughout the study period (46.58%) and minimum in the extreme age groups less than 10 year and above 50 years.

TABLE 2: AGE WISE ANNUAL DISTRIBUTION OF MALARIA CASES (2018-2022)

Year	0-10 years	11-20 years	21-30 years	31-40years	41-50years	>50 years
2018	03 (3.4%)	20 (22.7%)	28 (31.8%)	12 (13.6%)	18 (20.4%)	07 (7.9%)
2019	10 (12.5%)	16 (20%)	25 (31.2%)	11 (13.7%)	10 (12.5%)	08 (10%)
2020	11 (10.5%)	18 (17.3%)	40 (38.4%)	15 (14.4%)	12 (11.5%)	08 (7.6%)
2021	07 (12.2%)	16 (28%)	12 (21%)	09 (15.7%)	07 (12.2%)	06(10.5%)
2022	00 (00%)	15 (25.4%)	19 (32.3%)	13 (22%)	08 (13.5%)	04 (6.7%)
Total	31 (7.98%)	85 (21.90%)	124 (31.95%)	60 (15.46%)	55 (14.17%)	33 (8.50%)

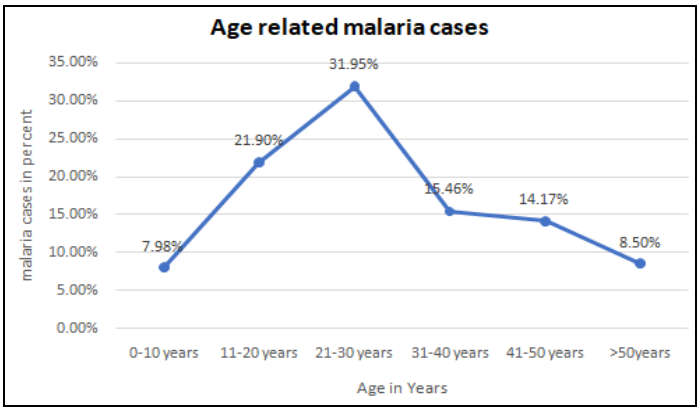

FIG. 3: MALARIA PREVALENCE AS PER AGE 2018-2022

As per **Fig. 3** overall malaria prevalence throughout the study period shows an increasing trend with age and peak at 21-30 years as 31.95% followed by decline. Extreme age group i.e less than 10 years and above 50 years show malaria prevalence rates 7.98% and 8.5% respectively. As per **Table 3** out of total positivity 388 of malaria cases 244 (62.88%) were male and 144 (37.11%) were female. Overall study period 2018-2022 showed more than 60% prevalence rate of malaria with peak 66.1% in 2022. P value was observed to be <0.05% i.e was observed to be significant due course of study period.

TABLE 3: GENDER WISE ANNUAL DISTRIBUTION OF MALARIA CASES (2018-2022)

Year	Male	Female	Chi-square X^2	P-value
2018	54 (61.3%)	34 (38.6%)	9.090909	0.002569
2019	52 (65%)	28 (35%)	14.4	0.000148
2020	64 (61.5 %%)	40 (38.4%)	11.07692	0.000874
2021	35 (61.4%)	22 (38.5%)	5.929825	0.014887
2022	39 (66.1%)	20 (33.8%)	12.23729	0.000468
Total	244(62.88%)	144 (37.11%)	-	-

As per **Fig. 4** maximum positivity was observed from urban area from 2018 to 2020 but situation reversed in 2021with maximum positivity from rural area and again flipped to urban predominance in 2022. Urban cases in 2018 malaria positivity were 86.30% which showed decline graph till 2022 to 57.60%. In contrast rural areas showed 13.60% in 2018 but increased number of cases in subsequent year with peak 54.30% in 2021.

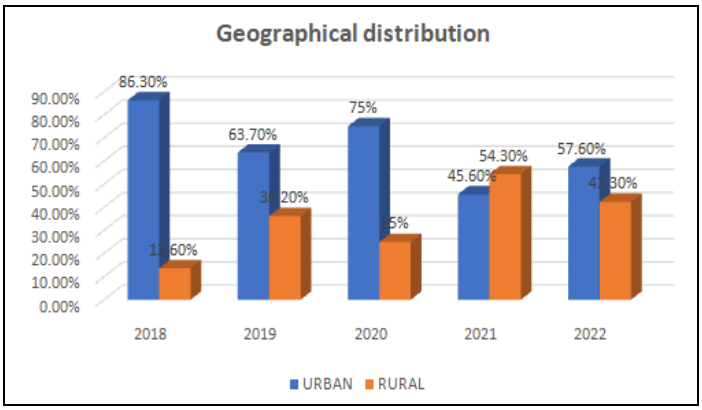

FIG. 4: GEOGRAPHICAL DISTRIBUTION OF MALARIA CASES (2018-2022)

DISCUSSION: Malaria being endemic in India, there has been a resurgence in different states and Chhattisgarh is one of them with the highest incidences of malaria cases. Over a period of five years, i.e January 2018- December 2022 patients with complaints of fever and suspected of malaria were subjected to malaria antigen detection by Rapid diagnostic test in the Microbiology laboratory.

There were 27,844 cases out of which 388 (1.39%) tested positive for malaria. Out of 388 malaria positive cases diagnosed by RDT, *P. vivax* cases were 71 (18.29%) and 303 (78%) *P. falciparum* cases and 14 (3.6%) mixed infection with a prevalence rate 1.39%, Ahmad *et al.* [5] in their study have reported *P. falciparum* as the most common species. The current study reveals an overall 32.95% decrease in malaria cases from 2018 to 2022 as compared to 46% decrease in India from 2019 to 2020 [6]. The present study showed the gender wise distribution of malaria cases was higher in males 244 (62.88%) as compared to females 144 (37.11%) and male to female ratio of 1.69:1, which is similar to Pradhan S *et al.* finding in their study which reported 71.4% male predominance [7].

In our study, malaria was found across all age groups, but the maximum number of cases were seen among the age group of 21-30 years 104 (26.80%), which is concordant with studies conducted by Bamou R *et al.* [8] and Narathattil *et al.* [9]. This can be linked with outdoor occupational

activities, which are more common in this age group [10]. Malaria is indeed influenced by environmental factors like rainfall, 60% humidity, and 20–30-degree centigrade temperature in months of July and August in Chhattisgarh, which are suitable breeding grounds for the mosquitoes that carry the malaria parasite in India [11].

In the present study, the maximum number of cases were observed in the months of July to August, which corresponds to the monsoon season in Chhattisgarh. Similar results were observed by similar results were observed by Singh *et al.* in their study. The reason behind this is that the rainy season leads to collection of water and promotes mosquito breeding, which is responsible for the high prevalence of malaria in this period [12].

CONCLUSION: The study you've described seems to highlight several key points about malaria trends and seasonal variations. The observed decline in the number of malaria cases from 2018 to 2022 is a positive trend, indicating potential progress in combating the disease. Understanding the seasonal variation, with peaks in cases during the rainy and winter seasons, underscores the importance of environmental factors in mosquito breeding and disease transmission.

Addressing the resurgence of malaria in India requires a multifaceted approach. The convergence of urbanization, drought, migration, poverty, and lack of awareness creates a complex web of challenges for addressing malaria in states like Chhattisgarh, which is often referred to as the "rice bowl of India", with a predominant rural population. Thus, collaborative effort, combined with government support for infrastructure improvement and healthcare access, is essential for controlling malaria not only in endemic areas but across the entire country.

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