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ORIGINAL ARTICLE

Malarial Trend of Ranibandh Block of Bankura District, West Bengal in a decade (2005-2014)

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Abstract

Background & objective*:* Malaria is a major public health problem in the world as well as in India. In India, West Bengal is one of the malaria endemic states contributing to huge number cases and deaths. Malaria Control Programme has given priority to Plasmodium *falciparum* malaria due to its life-threatening complications. But in some endemic areas , Plasmodium *vivax* also is playing a major role contributing to more than 90% of total malaria cases and also in maintaining perennial transmission. The objectives of the study were to study the rising trend of P. vivax in a block (Ranibandh) of Bankura district of West Bengal and the role of P. *vivax* in perennial transmission of the disease in the study area.

Method: Data of malaria cases of last 10 years (2005-2014) were collected from District Health Office of Bankura District. Retrospective statistical analysis was conducted with the help of Microsoft Excel sheet and for graph plotting Origin (ver. 8) was used.

Result: Ranibandh block of Bankura is contributing to 59% of total malarial cases of the district. In 2005, Ranibandh block reported 49.5% P. *falciparum* and 50.1% P. *vivax* cases, while in 2008 P. *falciparum* and P. *vivax* cases were 88.5% and 11.5% respectively among the total malaria cases. Proportion of P. *falciparum* cases were decreased from 28.5 % to 7.4 % during the year 2009 to 2014, while P. *vivax* cases were showing increasing trend from 71.5% to 92.6 % in the same duration.

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Interpretation & conclusion: In Ranibandh block, increasing trend of P. *vivax* malaria during 2009-2014 is a matter of concern. The decrease in P. *falciparum* cases may due to the Artemisinin Based Combination Therapy (ACT). But P. *vivax* malaria situation is alarming and indicating a need of field based research giving emphasis on vector dynamics, insecticide susceptibility and relapse pattern of P. *vivax*.

Key words: Malaria Elimination, Plasmodium *falciparum,* Plasmodium *vivax,* Endemicity, West Bengal

Running title: Malarial Trend of Ranibandh Block, bankura

Introduction

Malaria is one of the major public health problems globally with an estimated 214 million of malaria cases and 438000 deaths.[1] In India, malaria is also an important cause of mortality and morbidity and is a public health concern. In 2015 (till November), India has reported 1036629 malaria cases with 687932 *(66.4%)* Plasmodium *falciparum* positive cases and 273 deaths. West Bengal alone has reported 22633 malaria cases with 5237 P. *falciparum* positive cases(23.1%) and 32 deaths.[2] It is documented that one third of the world's population are at risk for malaria in India, where 50% of the total cases is P. *falciparum* and other 50% is P. *vivax.*[3]

Government of India, Researchers and Funding Bodies in India as well as globally[4] have given priority to control P. *falciparum* malaria in the country because of the life threatening complications of P. *falciparum.* In contrast, Plasmodium *vivax* species is considered as a "benign" infection and supposed to have an uncomplicated course of illness.[3,4,5] Recently, some complicated cases from vivax malaria have been reported[3, 6, 7 ,8,9,10,11,12]. Ten countries including India are at the risk of vivax infection. In some regions, P. *vivax* malaria is very important in maintaining the perennial indigenous transmission. [3, 4, 13] Thus, high emphasis on P. *falciparum* though appropriate, P. *vivax* malaria should not be ignored.

These two plasmodium species are distinct in biologically and clinically, and different strategies are needed to combat P. *falciparum* and P. *vivax* challenges.[10,11] Several new initiatives have been launched from time to time for combating the disease, specially the falciparum malaria, but the situation remained static and even worsens in year of good rainfall[11]. However, the disease scenario has changed due to the emergence of Chloroquine resistance mainly in P. *falciparum* and occurrence of severe and complicated cases due to P. *vivax* infection reported from India and many other malaria endemic countries[10, 14,15].

Climate plays an important role in dynamic and transmission of malaria. Role of rainfall is crucial in providing suitable habitat for mosquito breed; moreover temperature is key driver for mosquito and parasite life cycle. The climatic of West Bengal provides suitable condition for adaptation of these species. The summer temperatures in the state ranges between 24°C and 40°C while the winter temperatures range from 7°C to 26°C[14]. Bankura district is one of the endemic regions for malaria in West Bengal. It is contributing distinct number of cases for total malaria cases of the state[16]. Ranibandh block of the district is constantly contributing the highest number of malaria case in the district. This study was undertaken to find out the current status of Plasmodium *falciparum* and P. *vivax* malaria in Ranibandh block of Bankura district and also to assess the trend of malaria in the block in last 10 years (2005 to 2014).

Material & Methods

Type of study: Record based descriptive epidemiological study showing the time and person distribution of P. *falciparum* and P. *vivax* cases malaria cases in a malaria endemic block of Bankura district of West Bengal

Study Area: Present study was conducted in Ranibandh block, a malaria endemic block of Bankura district. Bankura district has 22 blocks and out of total malaria cases, Ranibandh block is contributing around 59% of the total malaria cases of the whole district[16]. Bankura is located on the geographical coordinates of 23° 15' 0" N, 87° 4' 0" E. Ranibandh is the western part of that district and part of Chota Nagpur plateau region. It has an elevation of 83 m of sea level. The area is mostly covered with seditious forest. Humidity varies from 71 to 90 %, temperature ranges from 29° C to 45° C and annual average rain fall rate is about 1,400 millimeters[14]. Ranibandh block is known for its endemic malarial situation of the district for the past few decades[16]. Table 1 depicts the variation of malaria cases detected at Bankura district during year 2005 to 2014. It was observed that Ranibandh is a highly malaria-affected block as compared to 21 other blocks of the same district.

Presently in Ranibandh block, malaria control is based on (i) DDT Indoor Residual Spraying (IRS) and Long Lasting Insecticidal Net (LLIN) distribution (ii) early case detection by microscopic examination of blood smear or the Rapid Diagnostic Test (RDT) and (iii) treatment of malaria with proper drug as per guidelines of NVBDCP, India.

In 2012 at the study block, 90% of the population was covered by LLIN at the rate of 1 bed net for 2.5 people[2]. Along with LLIN, DDT spray is being conducted based on the

epidemiological data as the vector control tool. The particular block is situated in an interior part of Bankura district, the whole population depends mainly upon the health services provided by the government. Majority of the people belong to lower socio-economic status and are from tribal community[14].

Data collection: Data were collected from District Health Office of Bankura for the period 2005 to 2014. This data recorded by the health department based on the laboratory test report of malaria cases of that particular block of Bankura District.

Data Analysis: The secondary data were analyzed for distribution of (i) Plasmodium *falciparum* and P. *vivax* malaria cases in Ranibandh block of Bankura district, (ii) seasonal transmission of Plasmodium *falciparum* and P. *vivax*, (iii) Person distribution of malaria cases according to age and gender. For data analysis Microsoft Excel and for graph plotting Origin (ver. 8) was used.

Results

A total of 13324 cases of malaria were detected from 22 blocks of Bankura district during 2005-2014 of which 6733 cases (50.5%) were detected only from Ranibandh block. At Ranibandh block, 4690 (69.6%) were infected with *P. vivax* and 2045 (30.3%) with Plasmodium *falciparum*. Table 1 depicts the endemicity of malaria of Ranibandh block in Bankura district.

Table 1: Year-wise malaria cases in the district of Bankura and in Ranibandh block of the district (2005 to 2014)

Year	Total number of malaria cases detected in Bankura district	Total number of cases from Ranibandh block	% of total malaria cases from Ranibandh block
2005	2293	1379	60.13
2006	1294	636	49.14
2007	1058	439	41.49
2008	1552	575	37.04
2009	1163	406	34.90
2010	1028	453	44.26
2011	1104	482	43.65
2012	1507	1018	67.55
2013	988	558	56.47
2014	1337	787	58.86

Figure 1 depicts the total malaria cases of Ranibandh block of Bankura District during 2005-2014. It was observed that during year 2005-2009, number of malaria cases was

decreased to a large extent (70% approx) over a duration of five years. However, number malaria cases again increased from 2009 up to 2014 with maximum number of cases in 2012.

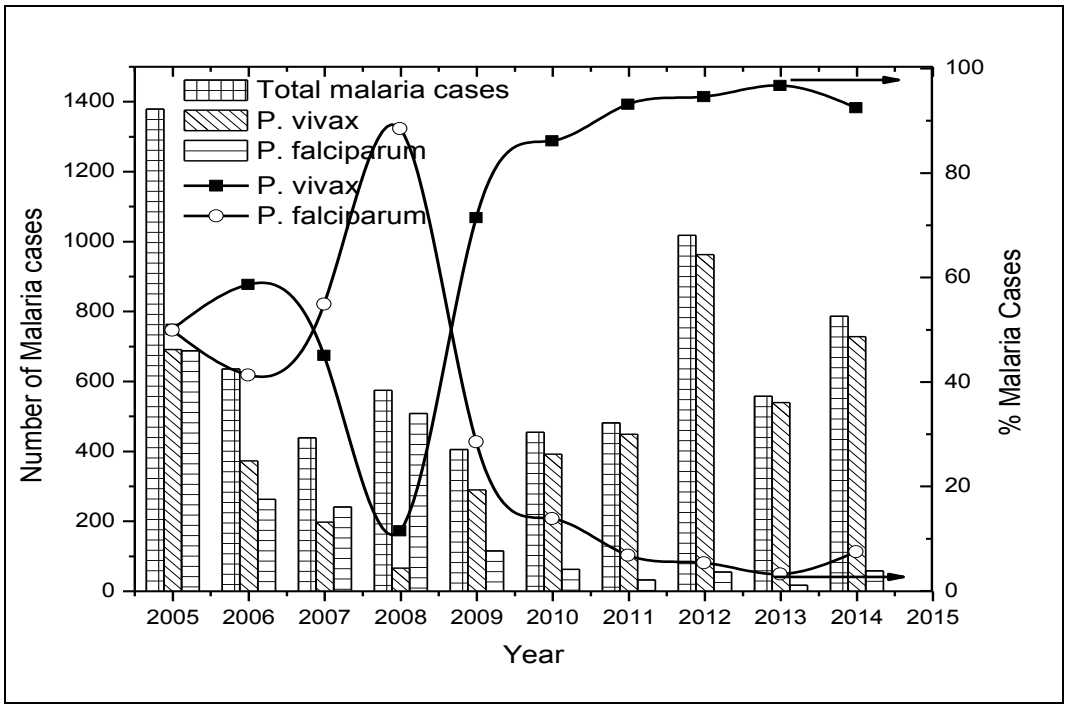

Figure 1: Year-wise distribution of P *falciparum*, P *vivax* and total malaria cases in Ranibandh block of Bankura district during 2005-2014.

Comparison of the number of two types of reported malaria cases are shown in figure 1 also. It was observed that total number of malaria cases including P. *vivax* cases was decreased during 2005-2008 whereas, Plasmodium *falciparum* malaria cases were increased during the same period, but 2009 onwards the proportion of P. *falciparum* cases were decreased while there was an increasing trend of P. *vivax* cases. The decreasing trend of P. *falciparum* might be due to effective diagnosis of parasite, indoor residual spraying and proper drug administration. This situation also might reflect the effective implementation of National Drug Policy for Malaria. The increasing trend of P. *vivax* since 2008 onwards may be due to drug resistance to P. *vivax*, relapse and reinfection cases and another reason may be that P. *vivax* was not considered as a priority for National Malaria Control Programme.

Table 2: Some malario-metric measures and deaths due to Malaria in Ranibandh Block of last 5 year (2010-2014)

Year	Population	ABER	SPR	API	PV%	Death
2010	110460	23.44	1.67	3.9	85	0
2011	118771	16.8	2.42	4.06	93	0
2012	121639	20.19	4.15	8.37	95	1
2013	124678	21.29	2.1	4.48	96	0
2014	126250	14.27	4.37	6.23	93	0

Table 2 showed the malariometric indicators. Average ABER for year 2010-2014 was 19.2%. Average SPR, API and *P. vivax* of year 2010-2014 is around 3, 5.4 and a 92.4 % respectively. However, during the period only one death due to P. *falciparum* was reported in the year 2012 (Report of District Health Office, Bankura).

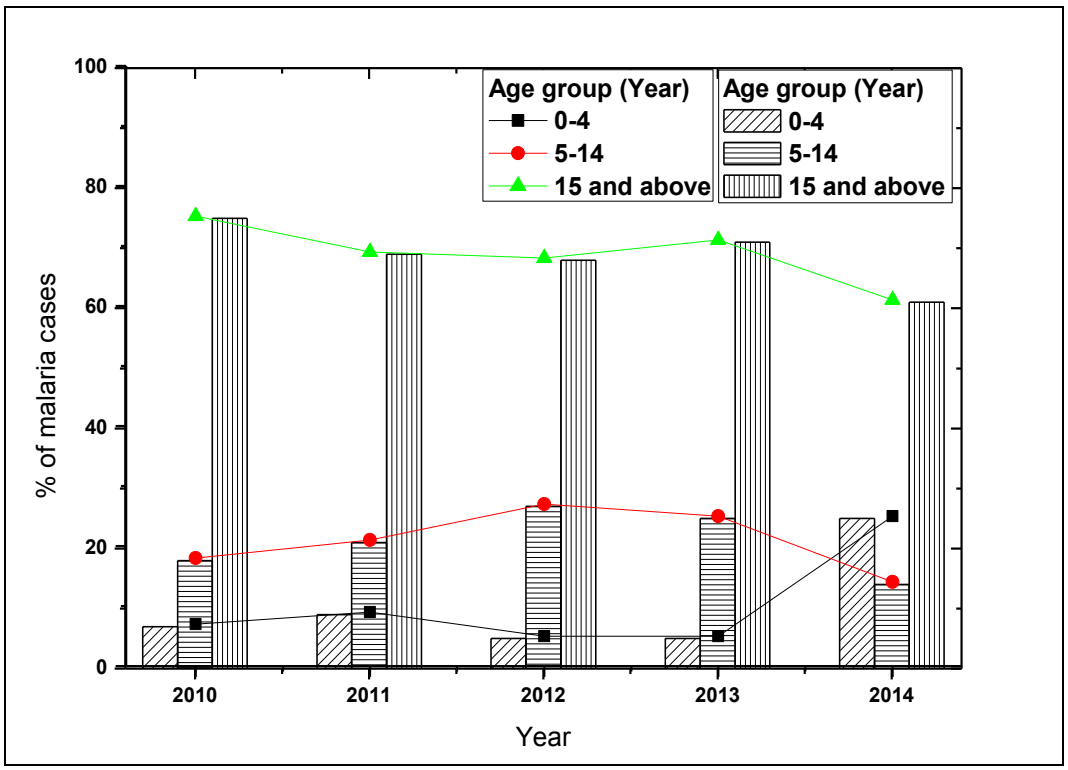

Figure 2: Age-specific distribution of total malaria cases of Ranibandh block during last 5 years (2010-2014).

Figure 2 reflected the distribution of malaria cases among different age- group of the population during year (2010-2014). Maximum number of malaria cases was for population with age group of 15 years and above. The population with age of 0-4 years is less affected. But in year 2014, the prevalence of malaria in younger age group (< 5 years age) has increased. The young children have become more vulnerable to malaria attack, indicating an alarming scenario in the present study area. If this situation continues in Ranibandh Block, then P. *vivax* infection may lead to severe morbidity and mortality due to renal failure, jaundice, and acute respiratory distress syndrome (ARDS), cerebral malaria, seizures, anemia, thrombocytopenia, pulmonary edema etc [3,4,5,7,8,9,10,11].

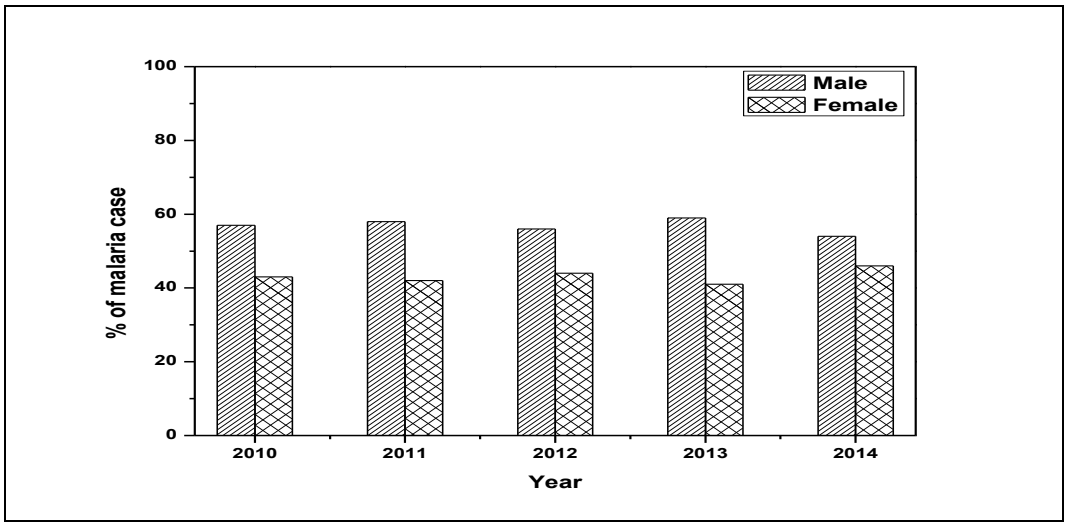

Figure 3: Gender-specific distribution of malaria cases in Ranibandh block during last 5 years (2010-2014).

It was observed that during five years (2010-2014), the male population was more affected with malaria then female population (Figure 3). During the period, 56.8% of malaria occurred in male population and 43.2 % cases in female population.

Figure 4 depicts month-wise distribution of P. *falciparum* and *P. vivax* cases during year 2010-2014 . Cases of malaria were reported throughout the year with distinct peak during the months of July- Septmeber for P. *vivax* malaria. In those months, Bankura district used to experience good rainfall. While Plasmodium *falciparum* malaria cases showed uneven distribution of malaria cases.

Table 3: The Malario-metric indicators in Ranibandh block before and after introduction of ACT.

Year	Population	slide examined	No Of Cases	PV	PF	API	AFR	AVR	
2005	109068	29097	1379	691	682	12.643	6.253	6.3355	PRE ACT
2006	110460	24662	636	373	263	5.7577	2.381	3.3768	
2007	110460	21062	439	455	510	3.9743	4.6171	4.1191	
2008	110460	23612	575	66	509	5.2055	4.608	0.5975	
2009	110460	28671	406	290	116	3.6755	1.0502	2.6254	POST ACT
2010	110460	27320	453	390	63	4.101	0.5703	3.5488	
2011	118771	6192	482	449	33	4.0582	0.2778	3.7804	
2012	121639	24557	1018	963	55	8.369	0.4522	7.9169	
2013	124678	26543	558	540	18	4.4755	0.1444	4.3312	
2014	126250	18018	787	728	59	6.2337	0.4673	5.7663	

In 2009 Artimisinin Combination Therapy (ACT) was introduced in Ranibandh and chloroquine resistant cases were also reported (Data of Regional Office of MOHFW, Kolkata). So, after the implementation of ACT, the scenario of P. *falciparum* was changed with a sharp decrease in number of P. *falciparum* cases as well as AFR. Table 3, represents

the pre-ACT and Post-ACT impact on the prevelance of P. *falciparum* cases. Initially in the year 2008, RDKs were monovalent and this may be one of the reason for low P. *vivax* as the microscopy was also limited.

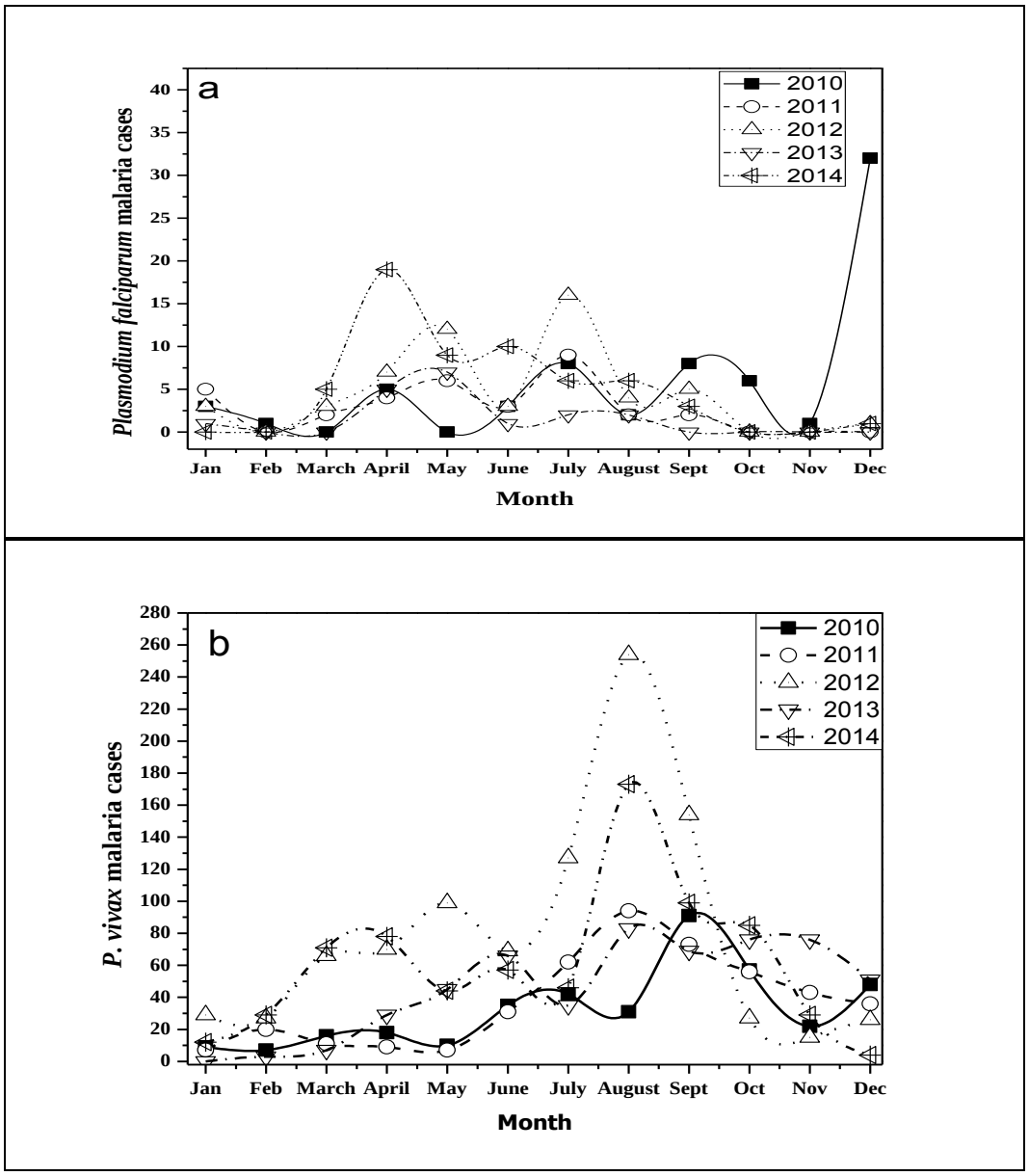

Figure 4: Month-wise distribution of P. *falciparum* and P. *vivax* cases in Ranibandh block.

The present study revealed that P. *vivax* malaria cases in Ranibandh block is high and likely to propagate to nearby regions of Bankura district. This burning issue needs to be addressed for control of P. *vivax* malaria.[11,13,17] The present data on P. *vivax* malaria situation at Ranibandh block would be vital in planning of malaria control intervention as strategy for elimination of malaria.

Discussion

During 11th five year plan period (2007-2012), malaria strategy was implemented for malaria control and prevention. 12th five year plan period (2012-2017) is targeted towards the scaling up malaria control interventions with a focus on high burden areas and categorized strategic interventions for achieving pre-elimination status. During the year 2017-2022 National Malaria Strategic Plan may include the concept of elimination of malaria from the India. However, in India with diverse malaria related problems along with well-established malaria control program, strategic planning of malaria elimination should not be confined only to scaling up of standard interventions.

The epidemiological information of the present study indicates that the average ABER for last 5 year (2010-2014) was 19, which reflects that surveillance work was well implemented. However, there was no significant change in API during years (2010-2014). During year 2014, API was 6.23 with five years (2010-2014) average of 5.4, which indicates that study area is endemic for malaria and indigenous transmission occurs. It was also observed that during year 2010-2014 an average increase of 92.2 % *P. vivax* malaria cases. After implementation of ACT there is a decrease of P. *falciparum* cases but there is no more change in API. So, P. *vivax* is responsible in maintaining the endemicity of that area. In case of P. *vivax* malaria, there may be several reasons/factors responsible for increase in cases in the study area where there is good P. *falciparum* control. Radical treatment of P. *vivax* is for long duration and it is very important tool for control of P. *vivax* transmission. So, incomplete radical treatment may be the major fact for increase in P. *vivax* cases. There might be some relapse cases of P. *vivax* malaria, which is responsible for perennial indigenous transmission. So, more emphasis should be given on radical treatment along with field level research for control of *P. vivax* malaria.

Age-specific distribution of total cases reveled that prevalence in adult population is very high and increasing trend of malaria cases in children is alarming one. While, gender-specific distribution showed that the males were more prone to malaria. This might be due to the difference in dress pattern (male are less clothed) and they generally lead more outdoor life than females. The majority of the adult population belongs to bread earner group. So, malaria has an economic impact in the family as well as in the country. P. *vivax* and P. *falciparum* cases were studied month-wise basis also for the years (2010-2014). P. *vivax* malaria showed a perennial transmission trend and peak coincides with Monsoon season

during July to September every year. While in case of P. *falciparum*, there was no fix period of transmission and different pattern was observed in every year. Correlating with the implementation strategy of NVBDCP and malarial prevalence of the study area, it is clear that after introduction of RDT for diagnosis and ACT combination therapy for treatment, sharp decreasing trend of P. *falciparum* malaria cases from year 2009 onward was observed. So, it may be concluded that there is a very good impact of artemisinin based combination therapy (ACT) for P. *falciparum* malaria control. Similar aspect has also been reported from urban Kolkata, India and from other countries[3,18,19, 20, 21]. As data regarding mixed infection is not readily available the topic has not been discussed.

Conclusion

The present analysis revealed that P. *vivax* malaria in Ranibandh block was substantial and likely to perpetuate. Whereas, there is good control on P. *falciparum* malaria after the implementation of ACT since year 2009 as the revised drug schedule of uncomplicated P. *falciparum* malaria. India may be able to proceed for elimination of P. *falciparum* with the help of simultaneous judicious use of RDK with microscopy, artemisinin based combination therapy (ACT) and IVM but increasing trend in P. *vivax* malaria is a matter of concern. The scenario of present situation at Ranibandh may be due to several factors such as climatic[6], vector dynamics[6], resistance of the vector towards the applied insecticide, resistivity of the parasite to the drug therapy involved [15,22,23], or due to relapse pattern of the P. *vivax* malaria[14, 18]. Further clinical and field-based studies are required in above mentioned field.

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