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An epidemiological study to identify high risk areas of malaria in Vizianagaram district of Andhra Pradesh, India, 2004 –2019

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ABSTRACT

Malaria, the disease that begins modestly enough has filled graveyards, killed kings and wrecked empires for millennia. A nasty parasite *Plasmodium* is one of the wonders of the world which constantly adapts to its surroundings by mastering sexual and asexual reproduction, by slipping immunological defenses of the *Anopheles* mosquito and human beings, rides in the belly of its arthropods to new victims. The epidemiology of malaria relies on three types of environments which are interdependent (Heggenhougen *et al*., 2003, Flessa 1999). Rural environments are more conducive to the spread of malaria as the rural environments (as compared to urban locations) generally provide the habitats congenial to mosquito breeding. The malaria situation of Vizianagaram district from 2004-2019. The SPR% ranges between (0.43-2.01) with in these 15years. There is a high in (2.01) and decrease in 2012-2019 (0.43-0.67). However, the Pf% ranges between (0.87- 4.75).The remarkable finding is when the SPR is low (0.43) in 2013. The Pf% is (0.87). Therefore, this data reveals that when SPR was on a lower side the Pf% may not low. The Pv% proceeded over Pf% did not show significant correlation of all the above-mentioned predictors cumulatively on SPR.

(key words: Anopheles, SPR: Slide Positivity Rate Pv: Plasmodium vivox, Pf: Plasmodium falciparum)

1. INTRODUCTION

Malaria, the disease that begins modestly enough has filled graveyards, killed kings and wrecked empires for millennia. A nasty parasite *Plasmodium* is one of the wonders of the world which constantly adapts to its

surroundings by mastering sexual and asexual reproduction, by slipping immunological defenses of the *Anopheles* mosquito and human beings, rides in the belly of its arthropodally to new victims. Malaria is ever present in the tropics and countries in Sub-Saharan Africa, which account for nearly 90 percent of all malaria cases. There is evidence in the medical writings found in China and India indicating that malaria has existed at least since 2700 B.C. (Heggenhougen *et al.,* 2003 & Rich *et al.,* 1998).

The epidemiology of malaria relies on three types of environments which are interdependent (Heggenhougen *et al*., 2003, Flessa 1999):

1. The biological environment comprising the parasite, Plasmodium and the breeding, resting and feeding habits of the malaria causing vector, the female Anopheles mosquito.
2. The physical environment constituting the ecological and climatologically factors such as humidity, temperature, and topography.
3. The host environment representing socio-economic factors or living conditions of the human population as well as the level of immunity.

II. RURAL MALARIA

Rural environments are more conducive to the spread of malaria as the rural environments (as compared to urban locations) generally provide the habitats congenial to mosquito breeding. Higher population density in urban areas can also be associated with lower incidence by allowing for a higher human-mosquito ratio, which reduces the number of infective bites per person. Robert *et al*., (2003) found that infective bites per person can vary from less than one bite per year in areas with low transmission to nearly as many as 3000 in high transmission areas. One or two infective bites per person affect only five out of 10 volunteers without immunity to malaria (Rickman *et al*., 1990). Gupta *et al*., (1999) observed a reduction in the number of bites per person, especially in endemic areas where people acquire anti-malarial immunity over time could be associated with lower malaria incidence. It is believed that urban malaria has risen in recent years.

STUDY AREA (VIZIANAGARAM DISTRICT)

Deaths due to malaria have been mostly observed in Visakhapatnam, East Godavari, Srikakulam, Vizianagaram, Krishna, Chittoor, and West Godavari districts. Incidence of malaria has been very high in Vizianagaram District (Health system – Fact sheets). So, the present study was conducted to understand the epidemiology of malaria in rural Vizianagaram Districts of Andhra Pradesh, India.

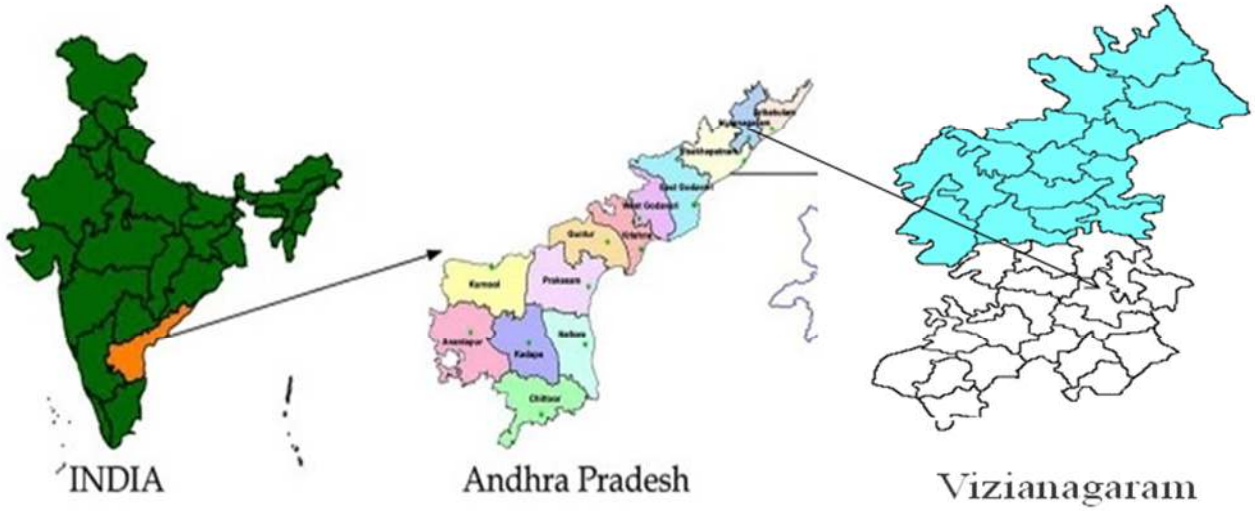

Fig: 1 geographical situation of Vizianagaram district

Before implementing a control strategy, it is important to study which factors actually influence malaria incidence. On the basis of the literature covered above, such factors as type of house, proximity to a water body, extent of irrigated area, and level of education have been identified as potential explanatory variables to be used to study malaria incidence in Vizianagaram District of Andhra Pradesh.

III. MATERIALS AND METHODS

Collection of data and information:

a) Geographical data was collected from the District Malaria Office (DMO) near Denkada (Vizianagaram District).
b) Meteorological data like the temperature Collected from the Meteorological Department (M.D).
c) Administrative data was collected from the Municipal Corporation (M.C).
d) Demographic data was collected from the state Government and Census office.
e) Socio economic data was collected from the state census, Department of Statistics and Social Welfare Board (DSSWB).

TABLE -1: Malaria incidence in Vizianagaram district 2004-2019

Year	Population	Malaria Positives			Indices						
		Active	Passive	Total	Pv	Pf	Total	Pf%	API	SPR	SFR
2004	18,76,547	1,91,084	1,17,860	3,52,582	694	2981	3675	2.52	1.98	1.04	0.85
2005	19,10,541	1,91,786	1,21,788	3,58,970	567	3512	4079	2.88	2.13	1.14	0.98
2006	19,15,875	1,73,344	1,25,280	3,36,764	220	2581	2801	2.06	1.46	0.83	0.77
2007	19,25,065	1,69,957	1,21,113	3,15,011	102	1864	1966	1.53	1.02	0.62	0.59
2008	19,44,761	1,92,624	1,34,689	3,62,227	861	6410	7271	4.75	3.74	2.01	1.77
2009	19,66,084	1,91,691	1,19,506	3,26,774	1133	2988	4121	2.50	2.1	1.26	0.91
2010	19,67,902	1,75,523	1,08,234	2,95,819	1275	2546	3821	2.35	1.94	1.29	0.86
2011	23,44,474	1,50,777	1,23,165	2,83,093	902	2169	3071	1.76	1.56	1.08	0.77
2012	23,50,317	2,10,723	1,68,389	3,92,594	520	2102	2622	1.24	1.29	0.67	0.54
2013	23,53,069	2,36,059	1,66,982	4,17,517	339	1454	1793	0.87	0.9	0.43	0.35
2014	23,65,495	2,18,061	1,75,011	4,04,187	492	1626	2118	0.92	1.06	0.52	0.4
2015	23,75,332	1,87,174	1,56,209	3,55,961	309	1811	2120	1.15	1.04	0.6	0.51
2016	24,87,094	1,93,861	1,36,711	3,43,494	216	1680	1896	1.22	0.92	0.55	0.49
2017	24,90,919	2,06,766	1,32,690	3,51,735	200	1692	1892	1.27	0.91	0.54	0.48
2018	24,95,739	2,12,087	1,36,098	3,59,411	215	1795	2010	1.31	0.96	0.56	0.50
2019	24,99,479	2,23,096	1,37,821	3,60,421	228	1820	2011	1.38	0.98	0.57	0.52

Collection of epidemiological data

The epidemiological data of India was collected from the National Vector Borne Disease Control Programme (NVBDCP). The malaria data of Vizianagaram of Four consecutive years was obtained from the State Government to compare the same with Andhra Pradesh. The data from the Chief District Medical Officer

(CDMO) was collected and analyzed to obtain an overall idea about the trend of malaria in the city.

IV. RESULTS:

Table-1: The malaria situation of Vizianagaram district from 2004-2019. The SPR% ranges between (0.43-2.01) with in these 15years. There is a high in (2.01) and decrease in 2012-2019 (0.43-0.67). However, the Pf% (Fig.2) ranges between (0.87- 4.75).The remarkable finding is when the SPR is low (0.43) in 2013. The Pf% is (0.87). Therefore, this data reveals that when SPR was on a lower side the Pf% may not low.

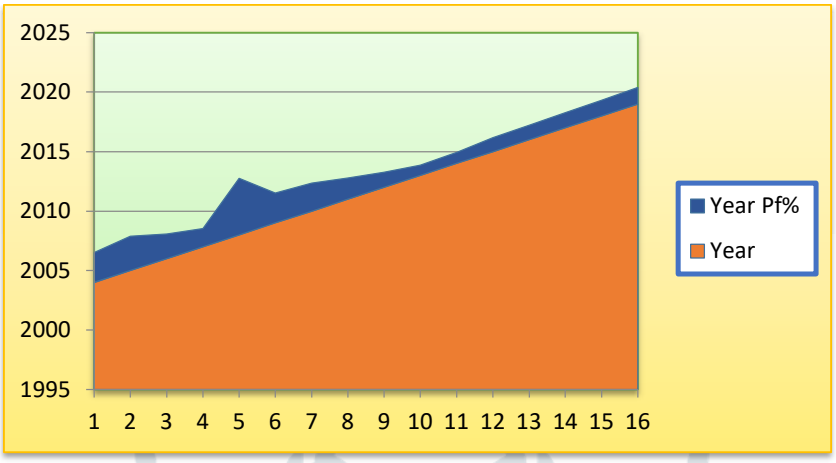

Fig.2:Pf% of Vizianagaram District (2004 -2019)

V. DISCUSSION

The malaria incidence in the late 1960s malaria cases in urban areas started to multiply, and upsurge of malaria was widespread. As a result, in 1975, 6.5 million cases were recorded by the National Malaria Eradication Programme (NMEP), highest since resurgence (Githeko and Wamai, 2002).

The malaria data of Vizianagaram, and Andhra Pradesh comparing from 2015-2019 is depicted in the above time period reported, the total cases reported from Vizianagaram from 2015-2019 is 7640 whereas Andhra Pradesh itself accounts for 2,02,858 cases of malaria. This shows that Andhra Pradesh contributes around 6.08% of the malaria cases. The SPR reported from Vizianagaram shows the highest in 2016 (1.13) and the SPR of Vizianagaram is nearly two times more than that of Andhra Pradesh but the Pf% of Andhra Pradesh shows an increasing trend from 2015 to 2019 ranging from (3.86 To 6.08). However, Pf% of Vizianagaram is decreasing by two times ranging from Pf% (3.11 - 3.22).

It was originally thought that Vizianagaram does not support significant levels of malaria transmission however it was found that this was not true as similar declaration by (Leon *et al*., 2006). From the parasitological survey, 2.8% and 1.8% of the study population were found to be infected in February-March and June-July, respectively. *P.falciparum* was the most common species followed by *P. Vivax and P ovale.* It is known that *P.falciparum* is the most dominant species in Madagascar (Mouchet *et al*., 1993). In our finding the SPR of three consecutive years (2017-2019) was taken into consideration in three different seasons i.e.; winter (November-February), summer (March-June) and rainy season (August-October). The SPR during

the summer (March-June) was comparatively higher than the other two seasons in our study period (0.83%, 073%, 4.68%) respectively. It was low in the winter season (0.40%, 033%, 042%).

A retrospective epidemiological study carried out by Yadav *et al.,* (2003), in Ahmedabad saw a gradual resurgence of malaria between 1965-1978 followed by low and high incidences. We also analyzed the health records of major public and private health facilities in Vizianagaram for the period between 2005-2019. *P. falciparum* was found to account for 64.5 if all malaria cases and *P. vivax* for the other 35.5% in contrast to our study the above author found *P. vivax* 70% chattopadhyay and Sengupta (2000), in Calcutta found about 95% of the confirmed malaria cases were of benign tertian type, while the remaining 5% were of the malignant tertian. Their finding showed a vast difference between Pf% and *Pv*% whereas in our study the difference between Pf% and *Pv*% is not much.

The random fever survey in the urban-tribal localities of Vizianagaram showed that among 3,205 blood slides collected 31.5% tribal and 22% urban were positive for malaria. The Pf% was 59.5% and 40.8% respectively. There was more variation observed between tribal and urban. The remaining 40% and 58.8% of the malaria cases were due to *P.vivax*. A similar study carried out by (Woyessa *et al*., (2004), in Ethiopia showed that the Pv% proceeded over Pf% which was just the reverse of our finding. Interestingly, another study in an urban Sahelian town with highly seasonal malaria transmission showed that among 2,459 people surveyed, 33% were positive for malaria infection and all were due to *P. falciparum.* (Othnigue *et al*., 2006). Our study revealed that both the types of infection were prevalent in the study population.

Interestingly, when multiple regression was done taking the predictors (temperature and relative humidity) along the malaria incidence, it did not show significant correlation of all the above-mentioned predictors cumulatively on SPR.

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