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Mosquito vector borne disease-malaria and public awareness in Sonitpur and Udalguri districts of Assam, India

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Abstract

Malaria is a serious and sometimes fatal vector borne disease caused by a parasite that usually infects a certain type of anopheles mosquito which feeds on humans. People who get malaria are typically very sick with high fevers, flu-like illness and shaking chills. While malaria can be a deadly disease, illness and death from malaria can usually be prevented. The current study has been carried out in different sites of Udalguri and Sonitpur district of Assam state during January 2014 to December 2016 with the principal objectives of evaluating the status of disease malaria and various factors of its occurrence with regards to malaria in that area to know its diversity. The awareness and knowledge of the local residents in the study area has also been taken into account. From the present study we have observed that there is lack of proper knowledge and awareness with regards to prevention of malaria among the local people. As far as prevention of malaria is concerned, it was seen that mosquito nets and coils were used by most of the people, but other alternative prevention measures such as prevention of water logging, proper disposal of waste, sanitation and personal hygiene should also be taken care of. Only those developed country where diseases transmission by mosquitos is no longer of primary health significance can afford specific programmes to control the pest mosquito population. Most developing countries will continue to concentrate their efforts against vector mosquitos. One of the advantages of environmental management is that, by reducing and suppressing the breeding habitats of vector mosquitos, it also reduces the population of pest mosquito species that use the same habitats for breeding.

Keywords: Malaria vectors, malaria, anopheles, plasmodium

Introduction

Malaria is a mosquito-borne deadly and dangerous disease prevailing in most North Eastern states of India with *Plasmodium spp.* being the predominant parasite. Because of the cosmopolitan distribution, mosquito vector borne disease are considered as a global problem. Mosquito borne disease malaria, the most deadly vector borne disease was held responsible for about 627000 deaths around the globe in year 2012 ^[1]. As estimated by World Health Organization (WHO), in 2013 there were 198 million cases of malaria and 584000 malaria deaths occurred worldwide. Malaria causes more than 600000 deaths every year globally, most of them children under 5 years of age ^[2]. Three South East Asian countries namely India (55%), Myanmar (21%) and Indonesia (21%) accounted for 97% of total cases in 2013 ^[2]. As estimated by WHO, in 2015 there were 214 million cases of malaria and 438000 deaths globally and there are 50 to 100 million cases every year in tropical and sub-tropical countries. The mortality due to malaria is more than 400000 every year throughout the globe, affecting mostly children under the age of 5 ^[3].

Malaria is transmitted among humans by female Anopheles mosquito which carries different disease causing parasite *Plasmodium spp.*, which is life-threatening if proper treatment is not provided on time. Female mosquito takes blood meals to carry out egg production, and such blood meals are the link between the human and mosquito hosts in the parasite life cycle for the successful development of the malaria parasite in the mosquito, the ambient temperature and humidity is most important factor for which Anopheles survives long enough to allow the parasite to complete its life cycle.

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Among seven principal mosquito vector species concerned with malaria transmission in South East Asia such as *Anopheles minimus*, *Anopheles stephensi*, *Anopheles sundiacus*, *Anphel maculatus*, *Anopheles dirus*, *Anopheles culicifacies*, *Anopheles fluviatilis*, of which *Anopheles minimus* sibling species is a leading species in North East India which is responsible for outbreak of disease characterized by increased *Plasmodium falciparum* infections attributing mortality cases [4]. There are four types of malarial parasite which infects human. *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae* and *Plasmodium ovale*, each of these four kinds has subtly different life cycle which results in slight variations in symptoms and also in treatments.

Malaria in India indicates 0.7 to 1.6 million confirmed cases and 400 to 1000 deaths annually [5]. India accounts for 61% of malaria cases and 41% of deaths due to malaria in South East Asian countries [6]. Malaria is also a major public health issue in the rural and tribal regions of Eastern, Central and North-Eastern states, mainly in 16 states of India and all North-Eastern states [7]. States like Orissa, Jharkhand and Chhattisgarh lead the Country in malaria while the case fatality rate is highest in Arunachal Pradesh, Assam, Meghalaya and West Bengal. During 2006, 1.78 million positive cases were reported with 1704 deaths. In 2005, the figure were 1.81 million cases with 963 deaths. It killed 2000 people in Rajasthan (2004) and 1000 people in Assam, Tripura and Bangladesh [8]. In Assam, malaria is one of the major public health issues. Assam covers a total geographical area of about 78,438 km² constituting 2.4% of India's land area [9]. Despite contributing only 2.6% of country's population, Assam alone records more than 5% of the confirmed malaria cases in India annually [10]. Malaria is endemic in all the districts of Assam. However, the intensity of malaria transmission varies in different districts [8]. The uneven distribution of malaria disease is largely concentrated among marginalized group of population in few districts [10]. The present investigation has been carried out in different locations of Udalguri district and Sonitpur district of Assam during January 2014 to December 2016 with the principal objectives of evaluating the status of malaria and various factors of its occurrence with regards to malaria in that area to know its diversity. The study concluded to have an appropriate control measure to be used in order to prevent the adverse effect caused by *Anopheles* mosquitoes.

Study Area

The study area Udalguri District lies along 26°46' N and 26°77' N latitude and 92°08' E and 95° 15' E longitude. Average temperature during summer is 22-36 °C and during winter 12-22 °C, rainfall is 1650 mm (Max) during June and July and relative humidity is 73-75% during June and July. Another study area Sonitpur lies along 26°37' 48" N latitude and 92°48' 0" E longitude. Average temperature during summer is 25-35 °C and 12-22 °C during winter. Average rainfall during June and July is 1600 mm (Max) and relative humidity is up to 75% during the month of June and July.

Table 1: Statistical data of Malaria in Udalguri District from 2014-2016

Year	Total Population	<i>Plasmodium vivax</i> +ve	<i>Plasmodium falciparum</i> +ve	Total Positive
2014	896469	1219 (42.09%)	1677 (57.91%)	2896
2015	901396	1222 (51.09%)	1170 (48.91%)	2392
2016	901396	741 (41.61%)	1040 (58.39%)	1781

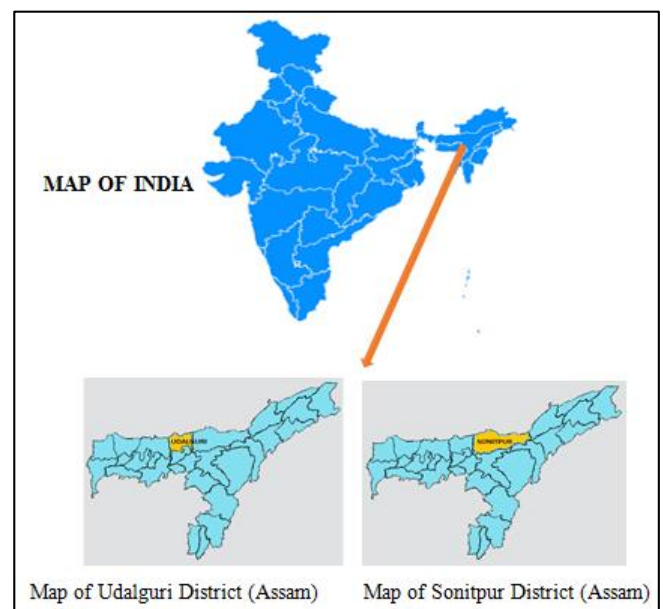


Fig 1: Map of Collection Sites

Methodology

For primary data, mosquito collection was carried out randomly in different locations of Udalguri and Sonitpur districts of Assam. Random collection was made while sampling fixed localities with the help of aspirators, test-tubes and fast cards during morning hours (06:00-09:00 hrs.) and evening hours (18:00-21:00 hrs.). The collected mosquito samples were stored in airtight test tubes and preserved using silica gel. Collected mosquitoes were identified using standard keys [11, 12, 13]. For secondary data, information was collected by means of interaction between local residents of the study area, which varies with regards to occurrence of malaria in that area. The data also acquired from Public Health Department, Sub-Centre of Public Health Centre, Journal, article, Newspaper and Internet.

Results

Survey was made to collect *Anopheles* mosquito in different places of Udalguri district and Sonitpur district in a random manner. Collected mosquito species has been identified in the Medical Entomology Division of Defence Research Laboratory (DRL) Tezpur, Sonitpur district.

After identification, it has been found that there are different species of *Anopheles* present in that study area where *Anopheles minimus* sibling species is a leading vector species which is responsible to carry the *Plasmodium spp.* as a parasite, causing malaria disease. Identified *Anopheles* mosquito vector species are- *Anopheles culicifacies*, *Anopheles dirus*, *Anopheles maculatus*, *Anopheles fluviatilis*, *Anopheles stephensi*, *Anopheles aconitus*, *Anopheles vagus*, *Anopheles subpictus*, *Anopheles varuna*, *Anopheles jeyporiensis*, *Anopheles elegans*, *Anopheles majidi*, *Anopheles annularis*, *Anopheles pallidus*, *Anopheles nivipus*, *Anopheles kochi* and *Anopheles minimus*

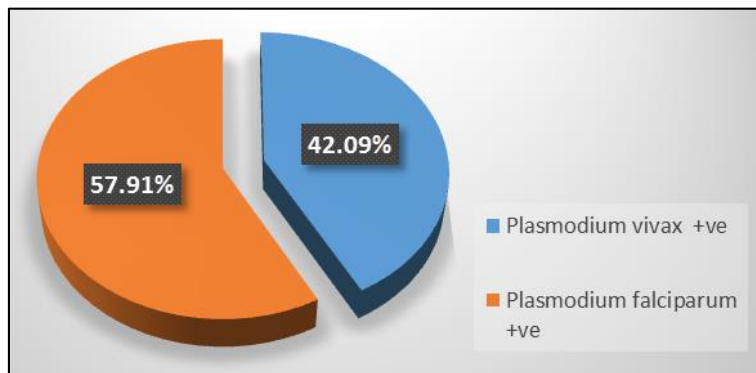


Fig 2: Statistics of Malaria in Udalguri District - 2014

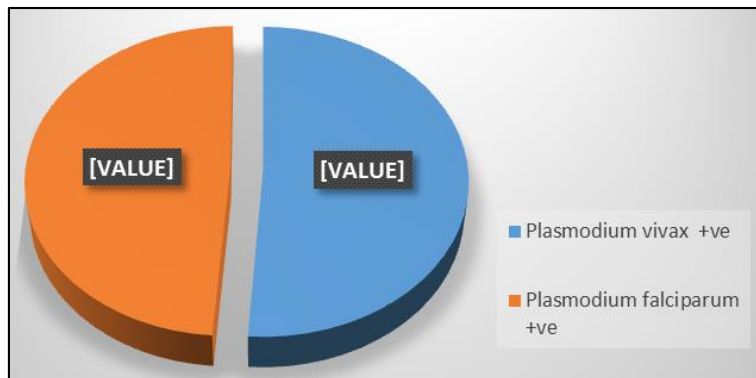


Fig 3: Statistics of Malaria in Udalguri District 2015

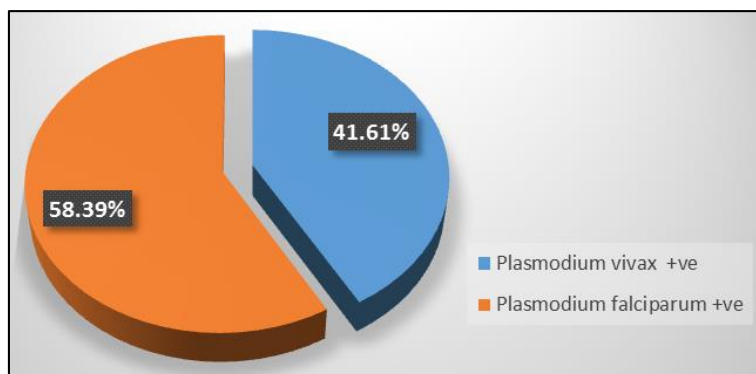


Fig 4: Statistics of Malaria in Udalguri District 2016

Table 2: Statistical data of Malaria in Sonitpur District from 2014-2016

Year	Total Population	<i>Plasmodium vivax</i> +ve	<i>Plasmodium falciparum</i> +ve	Total Positive
2014	2065832	59 (38.06%)	96 (61.94%)	155
2015	2070822	116 (60.42%)	76 (39.58%)	192
2016	2075774	38 (54.29%)	32 (45.71%)	70

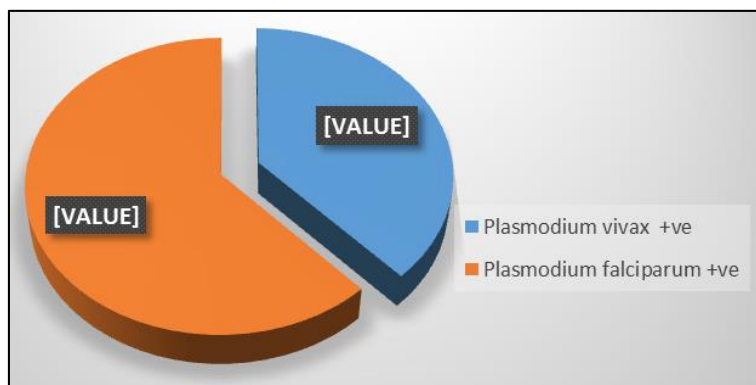


Fig 5: Statistics of Malaria in Sonitpur District 2014

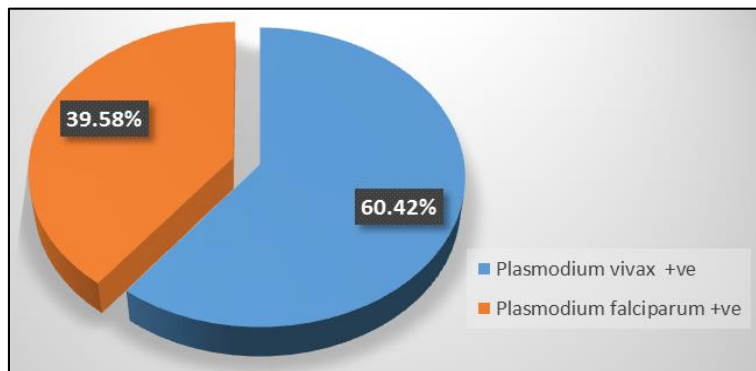


Fig 6: Statistics of Malaria in Sonitpur District - 2015

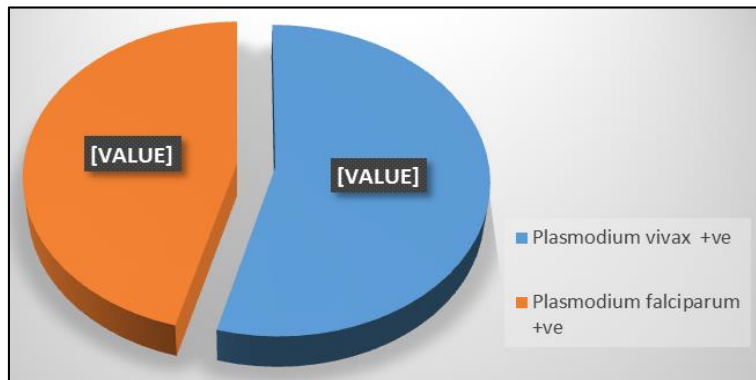


Fig 7: Statistics of Malaria in Sonitpur District-2016

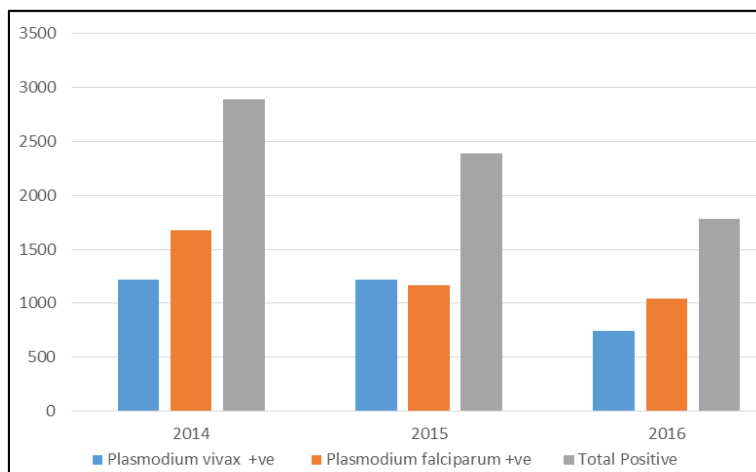


Fig 8: Comparative Statistics of malaria in Udalguri District from 2014-2016

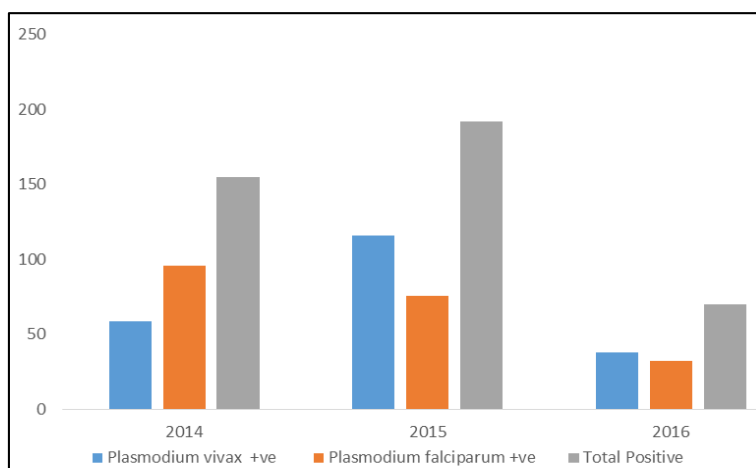


Fig 9: Comparative Statistics of malaria in Sonitpur District from 2014-2016

It has been observed from the data collected that there has been a varying trend with respect to the occurrence of malaria in Udalguri and Sonitpur districts which seems to be on the rise in the year 2014 in Udalguri district and 2015 in Sonitpur district. This is evident from the data obtained that the total positive cases in 2014 were 2896 which decreased to 1781 by the year 2016 in Udalguri district (Table 1). Whereas the total positive cases in 2015 were 192 which is slight decrease in 2014 with 115 cases and more decrease in 2016 with only 70 cases in Sonitpur district (Table 2). It has also been observed that the total number of cases infected by *Plasmodium falciparum* generally exceeds the total number of cases by *Plasmodium vivax*. During the year 2014, the total number of cases infected by *Plasmodium falciparum* was seem to be at its peak in both the districts (Figure 2 and 5), whereas the total number of cases infected by *Plasmodium vivax* was seem to be at its peak in the year 2015 in Udalguri district (Figure 3) and Sonitpur district (Figure 6) respectively. Finally, the year 2016 have recorded more *Plasmodium falciparum* positive cases than *Plasmodium vivax* cases in Udalguri district (Figure 4) and vice versa in Sonitpur district (Figure 7).

It is also worth mentioning that *Plasmodium falciparum* seems to be the most dominant species causing malaria in the study area of Dhansiri and Kabirdanga in which at least 70% malaria reported from these area of Udalguri district. Another place Nachanshali of Udalguri district is also malaria prone area which is caused by *Plasmodium vivax* species. The results also reveal that cases by *Plasmodium vivax* has gradually declined from 2014 onwards and attained a minimum in 2014 and 2016, whereas it has however increased in the year 2015 in both the districts (Figure 8 and 9). On the contrary, *Plasmodium falciparum* positive cases has simultaneously reduced from 2014 to 2016 in both the districts.

Awareness of the local people of the study area

Interaction with the local residents of both the districts were done at a random basis from different areas of Udalguri and Sonitpur districts to obtain the feedback of people on various aspects of malaria. Based on the feedback from the enquiries made, it was found that the most common symptom of malaria was fever and chills which was followed by continuous fever. The people of the area believe that mosquito bite is the reason behind malaria transmission, some of the people also thought that malaria can occur if there they are in the close proximity with the malaria patient. They also thought that stagnant water was the main breeding source while others believe that rotten places were the main places were the main source of breeding. About the diurnal occurrences of mosquitoes and their possible living places they feels the dark corner of houses whereas less of them feels it to be paddy fields. It is important that most of them are concerned to use mosquito net to protect from malaria, only few of them concentrates more on improving their personal hygiene.

Strategy to control of vectors of human diseases (Malaria)

Mosquitoes have long been a part of our ecosystems, but human activities for urbanization, industrial development, agriculture etc. have increased the population much beyond their natural levels, which transmit diseases from mosquitoes to man, man to man and cause serious annoyance problem. Hence control of vectors by vector management has to be

highly organized based on sufficient data on the vectors, humans, the environment, and the feasibility of application of the best and suitable techniques and materials depending upon local situation without having any side effects on humans, animals and the environment to prevent the spread of mosquito borne diseases. Government had already launched so many control measure through Public Health Centre and Sub-Centre of health department.

Early Diagnosis and complete treatment and Integrated Vector Management are the two main task to control malaria diseases. Under Integrated Vector management Programme there are some other aspects which has to be implemented in the control measure task. These are Indoor Residual Spray through which adequate spraying should be done in the malaria prone areas. Insecticide treated bed nets and long lasting insecticide nets should be distributed to each and every family in malaria endemic areas. Through awareness programmes people should be made aware to maintain hygiene and take necessary precautions to prevent malaria.

Another aspect is Biological Control method; the advantage of this method is to reduce the adult mosquitoes and larvae through natural enemies or other biological and naturalistic means; such as spider, mites, dragon and damselflies, birds, frogs etc. which eat adults. Mosquito larvae are fed by water beetle, nymph of dragon fly, water spiders and larvicidal fishes specially *Gambusia affinis* and *Poecilia reticulata* has widely been used to predate upon the mosquito larvae.

Discussion and Conclusion

It is a well-established fact that Anopheles spp. are significant vectors of malaria in South East Asia. Malaria is also one of the major concerns to public health in many north Eastern states of India including Assam [14]. The warmer climate, prolonged rainfall and high relative humidity in Assam provides congenial environment for mosquito vectors to breed and proliferate, thereby transmit parasites [10, 15].

The awareness and knowledge of the local residents in the study area has also been taken into account. From the present study we have observed that there is lack of proper knowledge and awareness with regards to prevention of malaria among the local people. In fact, the very basic knowledge that malaria is solely by mosquito bites is lacking in many of them. Most of the residents even holds the misconception that continuous fever is a symptom of malaria. Furthermore, it was also observed that few people thought that malaria can be transmitted if a person is in close proximity with a patient suffering from malaria. As far as prevention of malaria is concerned, it was seen that mosquito nets and coils were used by most of the people, but other alternative prevention measures such as prevention of water logging, proper disposal of waste, sanitation and personal hygiene should also be taken care of.

The status of malaria in Sonitpur and Udalguri districts of Assam is always a matter of concern. This due to the landscape which includes hilly areas, small streams, tea gardens, ground pools, irrigated lands, patches of fresh water and weather which is humid during summer. All of these facilitates an ideal breeding site for Anopheles mosquitoes which prefer to breed on clean and slow moving water.

The severe occurrence of malaria in these region reveals the fact that there is an urgent need to create awareness among the local residents. The awareness programmes should provide basic knowledge on the possible breeding sites of malaria,

improvement of personal hygiene and sanitation. The National Vector Borne Disease Control Programme (NVBDCP), National Health Mission (NHM) and Public Health Centres are trying their best in this regard. In 2016, the Directorate of NVBDCP and NHM, in collaboration with Indian Council of Medical Research (ICMR) and WHO launched the National Framework for Malaria Elimination (NFME) 2016-2030 with the goal to eliminate malaria completely from India by the year 2030^[16]. Furthermore, a constant effort and cooperation from the local people is also required to reduce the breeding sites of Anopheles mosquitoes. Hence, maintaining a clean and malaria-free nation has become an issue of paramount importance.

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