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Original Research Article

Assessment of dengue mosquito breeding sources and source reduction at a coastal village in Puducherry

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ABSTRACT

Background: Dengue virus can cause a wide range of illness in humans, from unapparent infection, to classic dengue fever and to fatal dengue haemorrhagic fever. Until a vaccine becomes available for public health use, primary prevention of transmission is crucial to decrease the burden of dengue, and control of *Aedes* is the only available strategy.
Methods: The mosquito larval survey was carried out in the month of November 2017 in Echangadu, a coastal village in Puducherry to assess mosquito breeding sources for the presence of dengue vector species. The survey was performed by selecting houses where freshwater was available. For each household, the presence or absence of possible breeding sources were recorded, as well as the presence or absence of mosquito larvae.
Results: Of the 102 houses surveyed, 20 of the houses were infested with *Aedes* larvae. A total of 182 containers were found in these households of which 47 containers were positive for *Aedes* larvae. Coconut shells, plastic, metal and discarded containers were the most often found breeding sites.
Conclusions: The larval surveillance indicators among the households surveyed revealed a very high risk of future dengue outbreak in the village. All the containers examined including those positive for *Aedes* larvae were safely disposed.

Keywords: Dengue fever, Breeding sites, *Aedes*, Puducherry

INTRODUCTION

Vector-borne diseases are responsible for a large proportion of worldwide human mortality and morbidity.[1] Among these diseases, more than 90% of infection-associated disability-adjusted life year (DALY) is caused by mosquito agents.[2] Dengue is considered as a serious public health problem with about 2.5 billion people at risk globally.[1] Dengue virus (DENV) can cause a wide range of illness in humans, from unapparent infection, to classic dengue fever (DF) and to fatal dengue haemorrhagic fever (DHF). Aedes aegypti and Aedes albopictus female mosquitoes are responsible for transmitting dengue virus to human.[3] In the last five decades, the number of DF and DHF cases reported to the World Health Organization (WHO) increased by 30-fold, mainly due to uncontrolled urbanization, population growth, frontier agricultural expansion, and an increment in human migrations.[4,5] In India, dengue is endemic in almost all states and is the leading cause of hospitalization among the communicable diseases.[6] During the year 2017, the National Vector Borne Disease Control Program (NVBDCP) reported around 200,000 laboratory confirmed cases of dengue.[7] Until a vaccine becomes available for public health use, primary prevention of transmission is crucial to decrease the

burden of dengue, and control of *Aedes* is the only available strategy.[8] Elimination of the breeding sites of *Aedes aegypti* from the human habitat is the most effective way to manage this vector.[9,10]

The Department of Community Medicine, Mahatma Gandhi Medical College & Research Institute (MGMC&RI), Puducherry is an active collaborator of health promotion and research activities with the Primary Health Centre (PHC) of Kirumampakkam, located few kilometres from the institution. During the onset of monsoon, in months of October 2017 dengue cases were reported in excess in Echangadu, a coastal village in Puducherry, which comes under the service area of Kirumampakkam PHC. Hence a team comprising of PHC and MGMC&RI staff was formed to study the dengue mosquito breeding sources and larval indices along with source reduction and health education activities.

METHODS

The survey was carried out in the month of November 2017 at Echangadu village. The village has 743 individuals residing in 210 households, the major occupation fishing being fishing and farming. The village consists of three major streets. Majority of the population in this village belongs to lower socio-economic class residing in semi-pucca houses with poor drainage facilities.

The survey was done using a semi-structured questionnaire capturing the information about mosquito breeding sites. The identification of immature stages of *Aedes aegypti* species were done by health inspectors and trained field staffs. At each house, water sources and containers viz., cement cisterns, coconut shells, discarded containers, flower pots, grinding stones, metal containers, metal drums, mud pots, overhead tanks, plastic containers, plastic drums, tyres and wells that were present inside and outside the houses were observed. For each household, the presence or absence of possible breeding sources were recorded, as well as the presence or absence of mosquito larvae. Breeding was also observed in open, public areas, like pools of stagnant rain water in the streets, or community wells. Out of 210 houses in Echangadu, on convenience sampling basis, 102 houses were surveyed in three days. Onsite source reduction was done with proper instruction to the concerned household representatives.

Calculation of Larval entomological indices were done for the households surveyed according to the NVBDCP guidelines.[11]

Household index households with larvae or pupae/ households examined.

Container index containers with larvae or pupae/ containers examined.

Breteau index containers with larvae or pupae/ households examined

The obtained data was entered in Microsoft excel and analysed using Epidata. The results were summarized as frequency and percentages.

RESULTS

Of the 102 houses surveyed, 20 of the houses were infested with *Aedes* larvae. A total of 182 containers were found in these households of which 47 containers were positive for *Aedes* larvae (Table 1). The house index (HI), container index (CI) and breteau index (BI) of the households examined in Echangadu village was 19.6%, 25.8% and 46.1% respectively (Table 2). All types of containers were found among the 102 surveyed houses. Coconut shells, plastic, metal and discarded containers were the most often found and had the highest number of breeding sites (Figure 1). However, not all these sources showed breeding. Mosquito larvae were most often found in cement cisterns (45%) and tyres (50%) than coconut shells (29.2%) and plastic or discarded containers (23.1%) which were less frequently used as breeding sites (Figure 2).

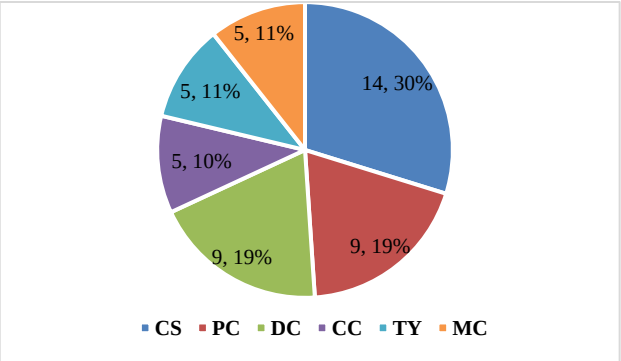

Figure 1: Breeding sites of *Aedes* larvae in Echangadu village.

CS-coconut shell; PC-plastic container; DC-discarded container; CC- cement cistern; TY- tyre; MC-metal container.

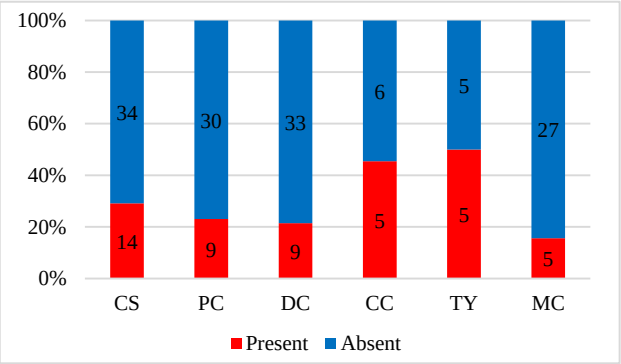

Figure 2: Number of containers in which larvae were present in Echangadu village.

CS- coconut shell; PC- plastic container; DC- discarded container; CC- cement cistern; TY- tyre; MC- metal container

Table 1: Street wise source detection and reduction for dengue among households in Echangadu village.

Street	No. of houses surveyed	No. of houses infested	Total containers	Containers positive for *Aedes*	Containers destroyed
Street 1	28	5	49	11	49
Street 2	48	11	89	23	89
Street 3	26	4	44	13	44
Total	102	20	182	47	182

Table 2: Larval entomological indices among households in Echangadu village.

Larval indices	Echangadu village (%)	Cut-off (%)	Comment
Household index	19.6	<1	High risk
Container index	25.8	<5	High risk
Breteau index	46.1	<5	High risk

DISCUSSION

Dengue, a fast spreading vector-borne disease is endemic in more than 100 countries with half of world's population living in areas at risk of this disease.[12] Heaviest burden of dengue was reported by Asia Pacific countries including India with 1,800 million people at risk of dengue infection.[13] World Health Organization-South East Asia (WHO-SEA) has placed India in `Category A' in terms of dengue endemicity as being a major public health problem, population growth, unplanned urbanization and poor water management systems leading to frequent water shortages and storage practices which have promoted breeding sites for the *Aedes* mosquito which primarily breeds in domestic water storage containers in and around human dwellings.[14,15]

In the current study the HI, CI and BI of the households examined in Echangadu village was 19.6%, 25.8% and 46.1% respectively. The findings are in line with a similar study done in Tirunelveli district in Tamilnadu where the HI, CI and BI were 48.2%, 28.6%, and 48.2% respectively.[16] HI describes the distribution of mosquito in a region. According to WHO and NVBDCP, an area is mentioned to be at high risk for the spread of dengue if it has HI> 10%, and low risk when HI <1%, which means that the villages is at high risk for dengue transmission.[11,17] CI illustrates the number of water reservoirs containing larvae. The higher the number the CI in a region increasingly available show a reservoir of water containing larvae, resulting in higher risk of occurrence and spread of dengue. The standards set by WHO for the value of CI is <5%.[17] Similarly, the criteria for a region of dengue fever is safe if it has a value of BI ≤5%, BI =5-20 including low risk, BI=20-35 including intermediate risk, while BI=35-50 including the high risk.[11,17] The calculated CI and BI for the village were higher than the standards indicating higher chances for breeding and dengue fever outbreaks in the future. The results of the study clubbed with the evidence of increase in morbidity and mortality due to dengue indicate the need of urgent action to reduce the source, transmission of dengue along with appropriate referral of cases and management.

Following the survey, health education for prevention and control of dengue was delivered at household level to ensure that each member of the family understood the mechanisms of infection and the key behaviours or activities that need to be addressed to prevent transmission, reduce severe disease and avoid fatalities. Special attention during this health education sessions was given to timely health care access and identification and destruction of water collection sites. Each session was accompanied by distribution of pamphlet depicting important information on dengue in the local language. In addition, the village head and Anganwadi representatives were counselled to promote frequent preventive activities for improving integration of the community in preventing dengue. The Health Inspector and the Medical Officer in charge of the village were informed about the higher surveillance indicators and the same was communicated to the Assistant Director, NVBDCP, Puducherry for further management.

The results of the study are limited only to the surveyed village and cannot be extrapolated to other areas of Puducherry. However, the results indicate the need the constant evaluation of these indices, especially during the mosquito breeding season. Additionally, the adult mosquito indices weren't calculated. Based on the results, we would like to recommend periodical health education demonstrating the indoor water collection sites and make the public aware of the appearance of larva and pupa. Chemical spraying (Temephos) could be done along with this activity on stagnant water collection sites. A follow up assessment to assess the impact of health education and source reduction. The grass root issues such as proper solid waste segregation and disposal practices should also be advocated to the public. The concrete drain construction of the village is half way complete for more than a year which must be constructed.

CONCLUSION

Coconut shells, plastic, metal and discarded containers had the highest number of breeding sites for dengue mosquito. The larval surveillance indicators among the households surveyed revealed a very high risk of future dengue outbreak in the village. The breeding sites were destroyed and reduced with appropriate instructions to the concerned household representatives. Health education for prevention and control of dengue was delivered at household level at Echangadu village. The findings recommend periodical entomological surveillance activities especially during the mosquito breeding season and health education sessions demonstrating the indoor water collection sites and make the public aware of the appearance of larva & pupa.

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