

## Original Research Article

# Breeding habitats of *Aedes aegypti* mosquitoes and awareness about prevention of dengue in urban Chidambaram: a cross sectional study

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## ABSTRACT

**Background:** Dengue is an acute viral infection with potential fatal complications. It can be controlled by effective vector control measures. The present study was carried out to identify preferred breeding habitats of the vector. Also the knowledge and awareness among people regarding dengue fever was assessed.

**Methods:** This is a cross sectional study conducted for a period of one month. Lot quality technique was used to select five streets in urban area, Chidambaram. A pre tested proforma and questionnaire was used.

**Results:** A total of 205 households was surveyed. The mean age of the study population was 43.38 years. 71.7% were females. 47.8% were qualified till college. 52.2% were housewives. 80% were aware that dengue was transmitted by mosquito bite. 31.7% of them knew that aedes mosquito spread the disease and 56.6% were aware that its a day biter. Most of the information was obtained through television (43.1%). 33.7% of them used mosquito repellents. 62% preferred seeking immediate medical care for fever during outbreaks. Numbers of indoor and outdoor breeding sites were 15 and 126 respectively. The refrigerator trays were the most common indoor breeding site (42.2%). Discarded plastic containers were the major outdoor breeding habitat. The association between knowledge about dengue with education and source of information was found to be statistically significant ( $p < 0.05$ ).

**Conclusions:** Dengue is one of the major public health problem which can be effectively controlled with active participation of the community and also by implementing sustainable vector control measures.

**Keywords:** Dengue, Vector, Aedes mosquito

## INTRODUCTION

Dengue is an acute viral infection with potential fatal complications.<sup>1</sup> Dengue virus (DENV) is a single positive-stranded RNA virus in the genus Flavivirus, family Flaviviridae. There are four distinct serotypes namely DENV-1, DENV-2, DENV-3, and DENV-4. Although infection with one serotype confers lifelong protection against that serotype, it does not provide protection against a secondary infection with a heterologous serotype.<sup>2</sup> The incubation of DENV in human is 4 to 14 days.<sup>3</sup> It is transmitted mainly by *Aedes aegypti* mosquito and also by *Aedes albopictus*.

The first epidemic of dengue-like illness was reported in Madras (now Chennai) in 1780 and the first virologically proven epidemic of dengue fever was reported in Calcutta and Eastern Coast of India during 1963-1964.<sup>1</sup> World Health Organization-South East Asia (WHO-SEA) has placed India in 'Category A' in terms of dengue endemicity as it is a major public health problem.<sup>4</sup> WHO estimates that more than 2.5 billion people are at risk of dengue infection. Population growth, increased urbanization, international travel, and climatic changes are the factors responsible for the emergence and re-emergence of dengue fever.<sup>5</sup> The disease usually peaks after the monsoon season, when the density of the two mosquito carrier species, *A. aegypti* and *A. albopictus* are

high.<sup>6</sup> In Tamil Nadu among the 32 districts, 29 districts were found to be affected with dengue infection.<sup>7</sup>

*A. aegypti* mosquitoes, the main vector for dengue fever are mostly confined to tropical and subtropical climates. *A. aegypti* typically breeds in closer proximity to humans.<sup>8</sup> The density and distribution of the vector depends on certain vital environmental factors like season, temperature, rainfall and humidity. The life span of the vector is strongly influenced by temperature and humidity as it survives best between 16 degree Celsius and 30 degree Celsius and a relative humidity of 60–80%.<sup>9</sup> *A. aegypti* is highly anthropophilic and it prefers to feed during the day and rest inside the houses.<sup>10</sup> *A. aegypti* usually breeds in clean water that gets collected in artificial containers like plastic cups, used tyres, broken bottles, flowerpots, and other water traps.<sup>6</sup> Elimination of these containers is the most effective way to reduce the mosquito breeding sites. The use of insect repellents, mosquito traps, and mosquito nets in houses can also help in reducing the number of bites due to mosquitoes.<sup>2</sup>

Dengue fever (DF) is characterized by an abrupt onset of fever with frontal headache and retro orbital pain, followed by myalgia, arthralgia, vomiting, and weakness. A generalized maculopapular rash appears one or two days after fever subsides. Some patients present with minor hemorrhagic manifestations such as petechiae. DF is generally self-limiting and rarely fatal. Most patients recover without complications in around 10 days after the onset of illness. Dengue hemorrhagic fever (DHF) is the more severe form of the disease and occurs in up to 5% of dengue cases. DHF is characterized by high fever, hemorrhagic manifestations, thrombocytopenia and haemo-concentration (>20% difference). Patients may progress to shock (dengue shock syndrome—DSS) with intense abdominal pain, persistent vomiting, weak pulse, and hypotension.<sup>2</sup>

Dengue can be easily controlled by effective vector control measures because there is neither a specific treatment nor an effective vaccine to reduce or prevent the disease in the community.<sup>11</sup> Therefore we decided to study the preferred breeding habitats of *A. aegypti* mosquito in urban area, Chidambaram. Also we assessed the knowledge and awareness among people regarding dengue fever and ways of preventing it.

## METHODS

The study area, Chidambaram is situated in Cuddalore district of Tamil Nadu state. The study was conducted in the month of September 2017. The objectives of our study were to identify the breeding habitats of *A. aegypti* mosquitoes and to assess the knowledge and awareness of breeding habitats and disease transmission among study population. Lot quality technique was used to select five streets in urban area, Chidambaram. All the houses in the selected street were subjected to this survey. A pre tested

proforma was used to identify the breeding habitats of *A. aegypti* mosquitoes and a pre designed questionnaire was used to assess the knowledge of study participants regarding dengue fever and control measures. The study period was one month. Prior to administering the questionnaire, the details of the study including the objectives and the methodology was explained in detail and informed consent was obtained.

The questionnaire had details regarding the socio demographic profile and questions regarding dengue fever and its mode of spread. The activities adopted for control of breeding sites were asked in detail. During the survey, all types of water holding containers both indoor and outdoor (around 50 meters) were inspected for the presence of Aedes larvae. Type of container(s) positive for Aedes larvae were recorded. The steps taken by the people to prevent breeding of mosquitoes and reducing mosquito bites were noted. The collected data was compiled and analyzed using SPSS software.

## RESULTS

A total of 205 households were surveyed. The socio-demographic details of the study participants are shown in Table 1. The mean age of the study population was 43.38 years. Most of the respondents were females (71.7%). 47.8% of the study group was qualified till college/university. Majority (52.2%) of the study participants were housewives.

**Table 1: Distribution of socio demographic characteristics of study population.**

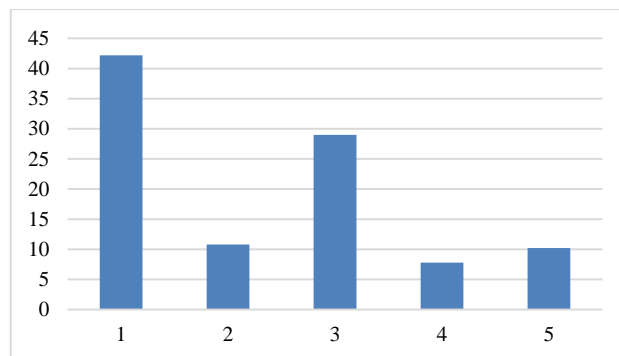
Socio demographic variables		Frequency (n=205)	%
<b>Gender</b>	Male	58	28.3
	Female	147	71.7
<b>Age (in years)</b>	<20	7	4
	20-39	93	45
	40-59	83	40
	≥60	22	11
<b>Occupation</b>	Full time	69	33.6
	Part time	9	4.4
	House wife	107	52.2
	Unemployed	20	9.8
<b>Education</b>	University	98	47.8
	Primary school	22	10.7
	Secondary School	73	35.6
	No formal education	12	5.9

The knowledge of the study participants regarding dengue fever is shown in table 2. 80% of the study population was aware that dengue fever was transmitted by mosquito bite. 31.7% of the respondents knew that Aedes mosquito spread the disease and 56.6% of them

were aware that the aedes mosquito is a day biter. Maximum information regarding dengue fever and its spread was obtained through television which constituted about 43.1%. About 33.7% of the respondents used mosquito repellents to reduce mosquito bites. 62% of the study participants were aware and had the habit of seeking immediate medical care for fever during dengue outbreaks.

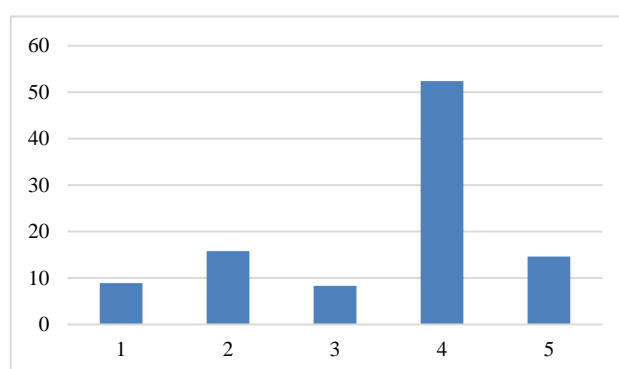
**Table 2: Distribution of knowledge of study participants regarding dengue fever (n=205).**

Knowledge		Frequency	%
Mode of spread	Mosquito Bite	164	80
	Air borne	2	1
	Blood transmission	7	3.2
	Water Borne	9	4.2
	Don't Know	23	11.6
Type of mosquito	Aedes	65	31.7
	Culex	2	1
	Don't know	138	67.3
Time of biting of mosquito	6 am to 8 am	116	56.6
	Don't Know	73	35.6
	6 am to 8 am and 7 pm to 9 pm	16	7.8
Source of information exposed	No answer	36	17.6
	Public announcement	27	13
	Printed media	14	6.9
	Outdoor media	19	9.4
	Radio	4	2
	TV	88	43.1
	Newspaper	17	8



**Figure 1: Distribution of indoor breeding habitats of *A. aegypti* mosquitoes.**

1: In the tray under the fridge-42.2%; 2: In the flower pot trays - 10.8%; 3: In the water container-29%; 4: in the opened water tank - 7.8%; 5: others - 10.2%.



**Figure 2: Distribution of outdoor breeding habitats of *A. aegypti* mosquitoes.**

1: In the flower leaves - 8.9%; 2: in the abandoned tyres - 15.8%; 3: in the roof gutter - 8.3%; 4: in the garbage - 52.4%; 5: others - 14.6%.

**Table 3: Association between knowledge of study participants with educational level and source of information.**

Variables		Study participants				Chi Square X <sup>2</sup>	P value
		Correct response		Incorrect response			
		n	%	n	%		
Education	University or college	87	88.8	11	11.2	13.8	0.003
	Secondary school	56	76.7	17	23.3		
	Primary school	15	68.2	7	31.8		
	No formal education	6	50	6	50		
Source of information	Yes	145	82.9	30	17.1	6.10	0.014
	No	19	63.3	11	36.7		

Among the 205 houses surveyed, numbers of indoor breeding sites were 15 (0.07%) and outdoor breeding sites were 126 (61.4%). The indoor and outdoor breeding sites are shown in Figures 1 and 2. Among the indoor breeding sites, tray under the refrigerator constituted about 42.2% followed by water storage drums which constituted 29% and flower pot constituted about 10.8%. In the case of outdoor breeding sites, garbage constituted about 52.4% followed by abandoned tyres which constituted 15.8%. Discarded plastic containers were the

major outdoor breeding habitat as per our observation. When government employed vector control measures in this locality about 34.6% of study population preferred using larvicids in breeding places. About 30.2% of study population preferred fogging as a preventive measure.

The association between knowledge about dengue with education and source of information is shown in table 3. The knowledge about dengue was positively correlated

with education or literacy level and the association between them was found to be statistically significant with a *p* value 0.003. Source of information is also positively correlated with the knowledge of dengue and the association between them was found to be statistically significant with a *p* value of 0.014.

## DISCUSSION

Several communicable diseases are endemic in India. To overcome this challenge, creating awareness among the common public plays an important role in controlling them. Dengue fever is one among them. Proper vector control measures can effectively prevent the spread of dengue fever. The presence of solid wastes around the households like broken bottles, plastic containers, old and used tires, coconut shells, etc., gets flooded with water after rainy season which serves as a potential breeding site for *Aedes* mosquitoes thereby increasing the transmission of dengue fever. In This study, the most potential outdoor breeding site was discarded plastic containers. In a study done in 2012 at Chennai, Tamil Nadu the most potential breeding sites were cement tanks, drums and discarded containers.<sup>11</sup> Similarly in a study done in rural and urban areas around Kolkata, India, reveals that the household plastics and glass bottles contributed to the existence of the dengue vectors to a considerable extent.<sup>12</sup> A similar result was obtained in a study done in Gampaha district of Sri Lanka were discarded containers constituted about 43.3%.<sup>6</sup> Thus the breeding sites can be effectively reduced by simple eco-friendly control methods like solid waste management, container management and routine clean up campaigns.

Fine nets can be used to cover water containers to reduce mosquito breeding. It is a convenient, inexpensive, and practical way to control the breeding sites of *aedes* mosquitoes. A trial study done in southern Taiwan found that covering outdoor buckets with fine nets resulted in significant reduction in density of dengue vectors.<sup>11</sup> In a study done in Ramanathapuram district, Tamil Nadu, India mixed breeding was observed in an unused well. Fine nets can be used in this situation to control the breeding of mosquitoes. Also, introducing fishes into the wells, the entire vector species population could be effectively reduced thereby avoiding any epidemic of dengue/chikungunya. Fishes are biological control agents that are well documented and practiced in control of vector breeding in India for the past several decades.<sup>13</sup>

Among the indoor breeding habitats, trays under refrigerator constituted about 32.2%. Similarly in a study done in Dhaka, Bangladesh refrigerator trays accounted for about 53% of positive indoor breeding sites.<sup>14</sup> Simple measures like periodic emptying of refrigerator trays will help in reducing this indoor breeding site.

In this study, the measures most commonly used to reduce mosquito bites was the use of mosquito repellents

(33.7%) followed by covering of water containers (18%). Similarly, in a study conducted in Iquitos, Peru respondents used mosquito bed nets (54.3%) and cleaned their houses (46.8%) periodically to reduce mosquito man contact. Also actions that were taken to reduce larval development sites were by removing (37.1%) or covering (26.4%) water containers.<sup>15</sup>

Due to high durability and low cost, plastics and their allied products has become an indispensable part of our life. It's a great news that for the first time in India, the state of Tamil Nadu has announced its decision to ban the manufacture and usage of several plastic products in the state from January, 2019. Improper disposal and management of plastic and glass wastes increases the possibility for breeding of mosquitoes, *Aedes* in particular. In developing countries, population growth and unplanned urbanization leads to frequent water shortage. The practice of storing water for domestic purposes further leads to the breeding of *Aedes* mosquitoes.<sup>4</sup> Household premises where water was stored for longer periods (i.e., more than 3 days) to cope with the uncertainty in power and water supply services tends to have more breeding sites for *Aedes* mosquitoes.<sup>14</sup> In Tamil Nadu, water scarcity leads to the habit of storing water for prolonged period which accelerates the breeding of *aedes* mosquitoes.<sup>9</sup>

It is observed that adopting simple measures can significantly reduce the breeding sites of *aedes* mosquitoes. These measures include covering water containers at home, cutting down bushes in the yard, eliminating standing water source around the houses, disposing of water holding containers such as tyres, parts of automobiles, plastic bottles and cracked pots, regular cleaning of garbage/trash, using window screens to keep mosquitoes out of the house and turning unused containers upside down to avoid water collection. Also stagnant water in coolers, unused containers, mud Pots, flower Pots, tray below the refrigerator should be cleaned on regular basis to avoid breeding of mosquitos. Awareness must be created among people regarding the breeding sites of *aedes* mosquitoes as it is the weakest link that could be broken easily in the chain of disease transmission and thereby reducing the vector density.

It is observed that, the literacy level was found to be significantly associated with the knowledge of dengue (*p*<0.05). As the level of education increases, the knowledge about dengue fever and its preventive measures also increases. The more educated the community is, less will be the incidence of the disease probably due to increased awareness and the ability to practice preventive measures. Similar results were obtained from a study done in Nepal where the study population stated that eliminating standing water around the house and disposing of water holding containers such as tyres, parts of automobiles, plastic bottles, cracked pots, etc., was useful to reduce the number of



mosquitoes.<sup>16</sup> In a study conducted in Iquitos, Peru education was the only factor significantly associated with reported activities to reduce larval breeding sites.<sup>15</sup> In contrast a study conducted in Malaysia reported a discrepancy between knowledge and practice of vector control measures.<sup>16</sup>

Source of information was also found to be significantly associated with the knowledge of dengue with a p value of 0.014. People who were earlier exposed to some source of information had better knowledge compared to those who had no exposure. Thus the population should be exposed about the information regarding dengue fever, potential breeding sites of the vector and the effecting ways of preventing the disease.

### Limitation

It is possible that some respondents might have provided socially desirable responses to some questions, especially in the attitude domain, since this survey was conducted by an interviewer-based use of a structured questionnaire. Also we collected data only in urban area which may not be representative for the whole town. We collected data only at a single point of time, so the trends we observed may have been different if we repeat the survey over several seasons.

### CONCLUSION

Dengue is one of the major public health problems which can be effectively controlled with active participation of the community. There is need to organize health education programs about the disease to increase the community knowledge and also to sensitize the community to participate in integrated vector control programs.<sup>1</sup> Health professionals should be mobilized for conducting awareness programs. Vector control measures for dengue can be effective only when they are implemented thoroughly, comprehensively and by maintaining sustainability.

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