



## Seroprevalence of dengue viral infection in patients attending to a tertiary care hospital in Kanchipuram, Tamil Nadu, India

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Submission Date: 18-06-2014, Acceptance Date: 02-07-2014, Publication Date: 31-07-2014

### How to cite this article:

#### Vancouver/ICMJE Style

K SB, Sastry AS, Senthamarai S, Sivasankari S. Seroprevalence of dengue viral infectioy AS, n in patients attending to a tertiary care hospital in Kanchipuram, Tamil Nadu, India. *Int J Res Health Sci* [Internet]. 2014 Jul 31;2(3):818-22. Available from <http://www.ijrhs.com/issues.php?val=Volume2&iss=Issue3>

#### Harvard style

K, S.B., Sastry, A.S., Senthamarai, S., Sivasankari, S. Seroprevalence of dengue viral infection in patients attending to a tertiary care hospital in Kanchipuram, Tamil Nadu, India. *Int J Res Health Sci*. [Online] 2(3). p.818-22 Available from: <http://www.ijrhs.com/issues.php?val=Volume2&iss=Issue3>

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### Abstract:

**Introduction:** Dengue virus infection is one of the most important human arboviral infection in India. Dengue viral infection outbreaks are frequently reported from various states of India. Activity of all 4 serotypes of dengue virus is constantly reported from different parts of Tamil Nadu. As dengue related mortality and morbidity is more common, this hospital based seroprevalence study was conducted to assess the magnitude of dengue virus infection and to know, whether there is an overall increase in the dengue infection prevalence in Kanchipuram. **Materials & Methods:** Total of 1,170 (606 males and 564 females) serum samples from suspected dengue fever cases were obtained for three years from January 2010 to December 2012. Samples were tested by a rapid qualitative immunochromatographic assay (Insight / DenV-Ab, Tulip Diagnostics (P) Ltd) for differential detection of dengue specific IgM and IgG antibodies. **Results & Analysis:** The overall seropositivity was 32.1% [298 (25.5%) were positive out of 1170 for dengue specific IgM and 78 (6.7%) were positive for dengue specific IgG or both IgM and IgG]. There was a gradual increase observed in dengue seropositivity over the study period of three years. **Conclusion:** This increase in dengue seroprevalence observed, may be an alarming /warning sign of the future epidemics which is again a serious matter of concern.

**Key words:** Dengue fever, dengue haemorrhagic fever, outbreak, serodiagnosis, Tamil Nadu

### Introduction

Dengue virus infection is one of the most important human arboviral infection [1]. The worldwide incidence of dengue fever (DF), dengue haemorrhagic fever (DHF) and Dengue shock syndrome (DSS) has increased dramatically in recent

decades [2]. Globally, it has been estimated that at least 2.5 billion people are at risk of Dengue, and approximately 975 million of these live in urban areas of the tropical and subtropical countries of southeast Asia [1,3]. Dengue virus infection is

endemic in many parts of India, and epidemic outbreaks have been frequently reported from Rajasthan, Tamil Nadu, West Bengal, Maharashtra, Punjab, Madhya Pradesh and Delhi [4-7].

Dengue virus infection in humans causes a spectrum of illness ranging from inapparent or mild fever to severe and fatal haemorrhagic disease [4,8]. Classic dengue fever is marked by a rapid onset of high grade fever, headache, retro-orbital pain, diffuse myalgia, weakness, vomiting, sore throat, an altered taste sensation, and a centrifugal maculopapular rash [9]. DHF and DHS are potentially fatal complications which are often associated with an infection by a second serotype [10].

Activity of all the four serotypes of dengue virus was established in Tamil Nadu as early as in 1960 [11,12]. Recently, dengue infection has been recognized in newer areas of Tamil Nadu from where previously cases were not reported [6,11]. Dengue epidemics have been earlier reported from Kanchipuram and adjacent cities like Vellore [12,13].

In this context, a serosurveillance analysis of data was done on the serum samples received for dengue testing at a tertiary care hospital at Kanchipuram in Tamil Nadu, during three years from January 2010 to December 2012. This hospital based seroprevalence study was conducted to assess the magnitude of Dengue virus infection and whether there is an overall increase in the dengue prevalence over these three years in Kanchipuram by estimating the seropositivity of Dengue virus specific antibodies (IgM and IgG) in patients with suspected dengue fever like illness.

#### Consent and Ethical Clearance:

Ethical clearance was taken from the ethical clearance committee of the Institute.

#### Materials and Methods:

Total of 1,170 (606 males and 564 females) serum samples from suspected dengue fever cases were obtained for three years (in year 2010 -309 samples, year 2011 -388 samples and year 2012 -473 samples) from January 2010 to December 2012.

Samples were tested by a rapid qualitative immunochromatographic assay (Insight / DenV-Ab, Tulip Diagnostics (P) Ltd) for differential detection of dengue specific IgM and IgG antibodies. Of the patients, 804 were adults (>15 yrs) and 366 were children (<15 yrs). The results were graded as reactive (visible band) or non reactive (no band).

Insight / DenV-Ab dipstick test is based on qualitative membrane based

immunochromatographic assay for the detection of dengue specific antibodies in whole blood, serum or plasma. The colored dengue specific antigen-colloidal gold conjugate present in the sample buffer complexes with specific IgM and IgG antibodies of dengue virus if present in the sample. This complex moves further on the membrane to the test region where it is immobilized by the specific IgM and IgG antibodies coated on the test lines on the membrane respectively leading to the formation of the pink color band (s), which confirms a positive test result. Procedural control was included in the assay, to indicate that test had been performed correctly. The IgG cut off in the test was set to detect high IgG levels which were characteristic of secondary infections and therefore, the primary dengue infection was defined by a visible IgM band without a visible IgG band, whereas a secondary infection was defined by a positive IgG band with/ without a positive IgM band. The procedure and interpretation of test results of the rapid Immunochromatographic assays were carried out according to the manufacture's literature guidelines [14,15]. Descriptive statistical analysis was used in the study.

#### Results:

During the study period of three years (January 2010 to December 2012), a total of 1,170 serum samples were screened for dengue specific IgM and IgG antibodies. In the year 2010 - 309 samples, in the year 2011 - 388 samples and in the year 2012 - 473 samples were tested.

Samples were received from 694 (59.3%) males and 476 (40.7%) females and 366 (31.3%) children (<15 years) and 804 (68.7%) adults (>15 years).

Age, sex and year wise distribution of suspected dengue cases has been shown in Table1.

**Table 1: Age, Sex and Year wise Distribution of Suspected Dengue Patients**

Year/ Suspected Dengue Patients	No. of Males <15 Years	No. of Males >15 Years	No. of Females <15 Yrs	No. of Females >15 Yrs
2010/309	52	152	30	75
2011/388	65	155	56	112
2012/473	85	185	78	125
Total 1170	202	492	164	312
Percentage (%)	17.3	42	14	26.7

The overall seropositivity was 32.1% [298 (25.5%) were positive out of 1170 for dengue specific IgM and 78 (6.7%) were positive for dengue specific IgG or both IgM and IgG].

In the year 2010, 33% i.e., 102 (86+16) were positive out of 309 cases; in the year 2011, 30.6% i.e., 119 (92+27) were positive out of 388 cases and in 2012, 32.76% i.e., 155 (120+35) were positive out of 473 suspected dengue cases.

During the study period of three years, total of 298 cases were positive for only IgM (i.e., 86 in 2010, 92 in 2011 and 120 in 2012) and total of 78 cases were positive for only IgG/both IgM and IgG (i.e., 16 in 2010, 27 in 2011 and 35 in 2012). There was a gradual increase in dengue seropositivity observed, over the study period of three years.

Year wise distribution of suspected dengue fever Cases and dengue positive cases is shown in table 2.

**Table 2: Year wise Distribution of Suspected Dengue Fever Cases and Dengue Positive Cases**

Year	Total number of suspected Dengue cases	Total number of Dengue Positive Cases (only IgM +)	Total number of Dengue Positive Cases (IgG+/both IgM & IgG+)
2010	309	86	16
2011	388	92	27
2012	473	120	35
Total	1170	298 (25.5%)	78 (6.7%)

Out of the 1170 samples which were screened (694 males and 476 females), IgM positivity was found to be 173 (24.9%) for males and 125 (26.3%) for females; IgG+/both Dengue IgM & IgG + positivity was found to be 54 (7.78%) for males and 24 (5%) for females. Overall IgM seropositivity (primary dengue infection) was more when compared to IgG/both Dengue IgM & IgG seropositivity (secondary dengue infection) both among adults and children.

Age and sex distribution of patients suffering with primary and secondary dengue infections is shown in table 3.

Overall seropositivity was observed to be more among males as compared to females both in the study group of adults and children. Male to female ratio was 1.45:1 (217/149).

In this study, dengue IgM seropositivity percentage showed an increase with increase in the monthly rainfall.

### Discussion:

Dengue fever and dengue haemorrhagic fever (DF/DHF) have become an important public health problem in many states of India in recent years. Remarkable increase in dengue fever and DHF related mortality and morbidity during the last decade has necessitated an effective surveillance system to detect the cases and adopt appropriate control measures against dengue vectors. Very early as 1960s, existence of all the four serotypes of dengue virus was proved in Tamil Nadu, but only after 1990, several outbreaks of DF/DHF were reported. Dengue was initially considered as urban problem; but now it has penetrated into rural areas also, due to various changes in the environment [11].

Laboratory diagnosis of dengue infection is crucial, as just by clinical presentations it may not be possible make an accurate diagnosis. Among the laboratory methods which are available for diagnosis of dengue infection, seroconversion of IgM or IgG antibodies is the standard test method for serologically confirming a dengue infection [3]. Dengue virus specific IgM antibodies tend to appear as early as 3 days after infection and remains in circulation for 1-2 months. IgG antibodies arise at about 7 days; they reach a peak at 2-3 weeks and persist for life [16].

In this study, overall seropositivity was 32.1%, out of 1170 dengue suspected cases. During the study period of three years, 298 cases were positive for only IgM indicating primary dengue infection and 78 cases were positive for only IgG/both IgM & IgG indicating secondary dengue infection.

Out of 1170 suspected dengue cases, 298 (25.5%) cases were positive for only IgM [i.e., 86 (28.9%) in 2010, 92 (30.9%) in 2011 and 120 (40.2%) in 2012] and total of 78 (6.7%) cases were positive for only IgG/both IgM and IgG [i.e., 16 (20.5%) in 2010, 27(34.6%) in 2011 and 35 (44.8%) in 2012]. There was a gradual increase observed in dengue seropositivity over the study period of three years.

**Table 3: Shows the age and sex distribution of Patients Suffering with Primary and Secondary Dengue Infections**

Age (in years)	Males with Primary Dengue Infection (With Only Dengue +)	Males with True Secondary Dengue Infection (IgG+/both Dengue IgM & IgG +)	Total Dengue Positive Males	Females with Primary Dengue Infection (with Only Dengue +)	Females with True Secondary Dengue Infection (IgG+/both Dengue IgM & IgG +)	Total Dengue Positive Females
Children(<15yrs)	39	9	<b>48</b>	28	5	<b>33</b>
Adults(>15 yrs)	134	45	<b>169</b>	97	19	<b>116</b>
Total	173	54	<b>217</b>	125	24	<b>149</b>

It indicates an increase in dengue virus activity, raising the question whether dengue is emerging/re-emerging as a major health problem in Kanchipuram. Gradual increase in probable secondary infection in a developing country like India could be attributed due to multiple serotype infection which again raises concern for the increase in the incidences of the more serious DHF/DSS. However, this has to be confirmed by genotypic characterization [8].

Similar findings were reported from a study from central India by Ukey PM *et al* at 2010, who reported 31.3% patients to be serologically positive for dengue infection [17] and by Gupta E *et al* at 2006 at New Delhi, who reported 44.56% patients were serologically positive for dengue infection among 1820 serum samples from suspected dengue cases [18].

In this study a higher seroprevalence of dengue infection was noted among males than in females. The male to female ratio in this study was 1.45:1. Similar findings were observed in study done by Sood S at 2013, where male to female ratio was 2.43:1[10]. However, this may be the representation of all the patients who visited to health care system to seek medical care rather the truly infected population.

Though dengue affects humans of all age groups worldwide, in some parts of the world it is mainly seen as a pediatric public health problem. However, in our study, adult population (>15 years) was the most affected age group when compared to pediatric age group (<15 years). Similar findings were observed in the study done by Sood S at 2013 at Rajasthan [10]. However our findings were contradictory to some of the studies done elsewhere

in India, who reported the pediatric age group as the most vulnerable when compared with adults [20,21]. Monthwise analysis of dengue infections showed that dengue cases increased in number from the month of July to October each year. Seasonality of transmission of dengue infection was more during cooler months, with an increase in prevalence soon after monsoon [22]. The presence of stagnant water after rainfall favors the breeding of mosquito vector, resulting in an increase in dengue cases in post monsoon months. Hence, vector control measures should be implemented during the monsoon and post monsoon months [10]. However, positive dengue cases were also detected even during dry months indicating the year-round activity of the mosquito vector [19].

### Conclusion:

This study showed a higher seroprevalence of dengue infection among suspected dengue patients; as well as a gradual increase in the seroprevalence of dengue infection over the study period of three years. This increase in dengue seroprevalence observed, may be an alarming /warning sign of the future epidemics which is again a serious matter of concern. Hence involvement of good laboratories for early and prompt diagnosis of dengue infection, coupled with vector control programmes and inducing awareness among the public, is needed in combating future epidemics of dengue and related mortality.

### Abbreviations used:

Dengue fever (DF)  
Dengue haemorrhagic fever (DHF)  
Dengue shock syndrome (DSS)

**Acknowledgement:**

Dean of Meenakshi medical college and research institute, MAHER. Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors/editors/publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

**Source of Funding:** Nil

**Conflict of Interest:** None

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