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Incidence of Dengue in and around Kannur, Kerala

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Abstract: *Dengue infection is an emerging disease and is a major health problem in our country. Globally the incidence of dengue has increased in the recent years. The WHO estimates that presently about two fifths of the world population is at risk for this viral infection. [(2)] Dengue fever (DF) is most common in older children, adolescents and adults. After an average intrinsic incubation period of 4–6 days (range 3–14 days), various non-specific, constitutional symptoms and headache, backache and general malaise may develop.[(11)]For transmission to occur the female Aedes aegypti must bite an infected human during the viraemic phase of the illness that manifests two days before the onset of fever and lasts 4–5 days after onset of fever. The present prevalence study is based on Dengue seropositive cases collected from different tertiary care hospital in Kannur district, Kerala. 97 samples of both sexes of all age groups studied. Immunoglobulin M (Ig M) antibody detection and Non structural protein (NS1) antigen detection were done. From a total of 97 dengue seropositive cases 34 cases were reported in the month of January (17) and July (17). Followed by 28 Dengue seropositive cases in the month of June (14) and August(14). It is essential that an adequate source reduction activity with community participation are the utmost important remedy for the prevention and control of Dengue*.

Key word – *Dengue, seropositive, Aedes aegypti, viraemic phase, Immunoglobulin M,*

I. Introduction

Dengue is an acute viral illness caused by RNA virus, belonging to the broad group Arboviruses, a member of the genus *Flavivirus* of the family *Flaviviridae,* is an arthropode-borne virus that includes four different serotypes (DEN-1, DEN-2, DEN-3, and DEN-4) and spread by Aedes mosquitoes. Dengue fever is a rapidly increasing public health problem in tropical and subtropical regions with a large percentage of the world's population at risk; the most recent estimates suggested 50 million infections and 20,000 deaths occur each year. [(1)] Dengue has been reported since the 18th century and major epidemics occurred at intervals of 10 to 40 years in Asia, Africa, and North America. The Aedes mosquito and the dengue virus were dependent on sailing vessels to transport them from one population to another, and when a new serotype was introduced, new epidemics occurred. [(3)]

The first epidemic of clinical dengue like illness was recorded in Madras (now Chennai) in 1780 and the first virologically proved epidemic of DF in India occurred in Calcutta and Eastern Coast of India in 1963-1964. [(4,5)] The first major epidemic of the DHF occurred in 1953-1954 in Philippines followed by a quick global spread of epidemics of DF/DHF.[(6)] In Kerala cases of dengue with some deaths were reported in 1997 for the first time, albeit detection of DEN-1, DEN-2 and DEN-4 viruses in the human sera in Kerala [(7)]. Dengue antibodies had been detected in human sera from Kozhikode, Kannur, Palakkad, Thrissur, Kottayam and Thiruvananthapuram districts as early as 1979 [(8)].

Dengue hemorrhagic fever (DHF) is more common in children less than 15 years of age in hyper endemic areas, in association with repeated dengue infections. However, the incidence of DHF in adults is increasing. DHF is characterized by the acute onset of high fever and is associated with signs and symptoms similar to DF in the early febrile phase. The presence of preceding warning signs such as persistent vomiting, abdominal pain, lethargy or restlessness, or irritability and oliguria are important for intervention to prevent shock. [(6)]Abnormal haemostasis and plasma leakage are the main patho physiological hallmarks of DHF. There Precise laboratory diagnosis of dengue infection is important not only for appropriate, specialist clinical care but also for accurate public health surveillance. Currently, the most commonly used methods for dengue diagnosis include detection of virus by: i) cell culture; ii) viral nucleic acid; iii) DENV antigens or specific antibodies rose to them. Using a combination of two or more of these techniques increases the accuracy of diagnosis.[(9,10)]

Typically, the onset of DF is sudden with a sharp rise in temperature and is frequently associated with a flushed face [(11)] and headache. Occasionally, chills accompany the sudden rise in temperature. Thereafter, there may be retro-orbital pain on eye movement or eye pressure, photophobia, backache, and pain in the muscles and joints/bones myalgia, arthralgia, leucopenia and thrombocytopenia may also be observed. The other common symptoms include anorexia and altered taste sensation, constipation, colicky pain and abdominal tenderness, dragging pains in the inguinal region, sore throat and general depression. These symptoms usually persist from several days to a few weeks. It is noteworthy that these symptoms and signs of DF vary markedly in frequency

and severity. The body temperature is usually between 39 °C and 40 °C, and the fever may be biphasic, lasting 5–7 days in the majority of cases. Diffuse flushing or fleeting eruptions may be observed on the face, neck and chest during the first two to three days, and a conspicuous rash that may be maculopapular or rubelliform appears on approximately the third or fourth day.

Dengue virus (DENV) is a positive-sense RNA virus with a lipid envelope. Its genome of about 11 kb encodes three structural proteins (capsid, pr M and E) that form the virus protective shells that encapsulate RNA, and seven non structural (NS) proteins (NS1, NS2A, NS2B, NS3, NS4A, NS4B and NS5). The latter are mainly involved in viral RNA replication. [(12)] The structural proteins are components of the mature virus particle whereas the NS proteins are expressed only in the infected cell and are not packaged to detectable levels into mature particles. NS1, a relatively conserved glycoprotein, exists in multiple forms in different compartments of virus-infected cells.[(13)] Antibody response to infection comprises the appearance of different types of immunoglobulin's; IgM and IgG immunoglobulin isotypes are of diagnostic value in dengue. IgM antibodies are detectable by days 3–5 after the onset of illness, rise quickly by about two weeks and decline to undetectable levels after 2–3 months. IgG antibodies are detectable at low level by the end of the first week, increase subsequently and remain for a longer period (for many years). Because of the late appearance of IgM antibody, i.e. after five days of onset of fever, serological tests based on this antibody done during the first five days of clinical illness are usually negative. Young and co-workers standardized a capture NS1 ELISA and demonstrated the presence of high levels of NS1 in the acute phase serum of patients suffering from secondary infection. They suggested that NS1 antigen detection could be useful for early diagnosis and also as a marker of viraemia.[(14)] NS1 levels in plasma correlated with viraemia levels and were higher in DHF patients than in those with DF.

Aedes aegypti is widespread in tropical and subtropical areas of South-East Asia; it is most common in urban areas. The rural spread of Aedes aegypti is a relatively recent occurrence associated with developmental and infrastructural growth initiatives such as expansion of rural water supply schemes and improved transport systems. In semi- arid areas as in parts of India, Ae.des aegypti is an urban vector and populations typically fluctuate with rainfall and water storage habits. [(15)] The female Aedes aegypti lays about 50 to 120 eggs in small containers such as flower vases, water-storage jars and other indoor water recepticles, as well as in rainwater collected in small containers such as cups, tyres, etc. Eggs are deposited singly on damp surfaces just above the water line. Embryonic development is usually completed in 48 hours in a warm and humid environment. Once the embryonic development is complete, the eggs can withstand long periods of desiccation (for more than a year). Eggs hatch once the containers are flooded, but not all eggs hatch at the same time. The larvae pass through four developmental stages. The duration of the larval development depends on temperature, availability of food and larval density in the receptacle. Under optimal conditions, the time taken from hatching to the emergence of the adult can be approximately 10 days and as short as seven days, including two days in the pupal stage. Soon after emergence, the adult mosquitoes mate and the inseminated female may take a blood meal within 24–36 hours. Blood is the source of protein essential for the maturation of eggs. Aedes aegypti, being a discordant species, takes more than one blood meal to complete one gonotropic cycle. This behaviour increases man–mosquito contact and is of great epidemiological importance. Aedes aegypti is highly anthropophilic, although it may feed on other available warm-blooded animals. Being a diurnal species, females have two periods of biting activity: one in the morning for several hours after daybreak and the other in the afternoon for several hours before dark. Aedes aegypti generally does not bite at night, but it will feed at night in lighted rooms. [(16,17)] More than 90% of the Aedes aegypti population rests on non-spray able surfaces, namely dark, humid, secluded places inside houses or buildings, including bedrooms, closets, bathrooms and kitchens. Less often is it found outdoors in vegetation or other protected sites. The preferred indoor resting surfaces are the undersides of furniture, hanging objects such as clothes and curtains, and walls. The adult Aedes aegypti has a lifespan of about 3–4 weeks. During the rainy Season, when survival is longer, the risk of virus transmission is greater. [(18)]

For transmission to occur the female Aedes aegypti must bite an infected human during the viraemic phase of the illness that manifests two days before the onset of fever and lasts 4–5 days after onset of fever. After ingestion of the infected blood meal the virus replicates in the epithelial cell lining of the midgut and escapes into haemocoele to infect the salivary glands and finally enters the saliva causing infection during probing. The genital track is also infected and the virus may enter the fully developed eggs at the time of oviposition. The extrinsic incubation period (EIP) lasts from 8 to 12 days and the mosquito remains infected for the rest of its life. The intrinsic incubation period covers five to seven days. [(19)]The uncommon modes of transmission are identified as vertical transmission from mother to foetus, transfusion-related transmission, transplantation related transmission, and needle-stick related transmission.

II. Methods

The study was intended to analyse the incidence of Dengue fever over a period of January to December 2016 (1 year) in Kannur District, Kerala. This Study also aimed to detect the sex and age prevalence of Dengue and correlate the occurrence of dengue with the breeding habitats of Aedes aegypti in monsoon seasons. The present prevalence study is based on Dengue seropositive cases collected from different tertiary care hospital in Kannur district, Kerala.97 samples of both sexes of all age groups studied. Immunoglobulin M (Ig M) antibody detection and Non structural protein (NS1) antigen detection were done.

III. Result And Discussion

A total of 97 dengue seropositive cases were reported during January to December 2016.In our study male gender predominance was observed with 61% (59 cases) and remaining 39% (38 cases) were females. Sex distribution of Dengue seropositive cases were shown in table 1. Study reports from Pakistan by Qureshi *et al*., [(20)] an Indian study by Vijayakumar *et al*., [(21)] and Thailand study by Tharava *et al*. [(22)] uniformly support that the male preponderance in the dengue fever and it is mainly due to the outdoor work nature of males compared to females. From the 97 seropositive dengue cases, 45 samples were tested positive for IgM capture ELISA and 46 samples were tested positive for NS1. 6 Samples showed positive result for both NS1 and IgM capture ELISA.

Table -1: Sex distribution of Dengue seropositive

Sex	NS1	IgM ELISA	Both NS1 & IgM ELISA
Male (59)	30	26	03
Female(38)	16	19	03
Total (97)	46	45	06

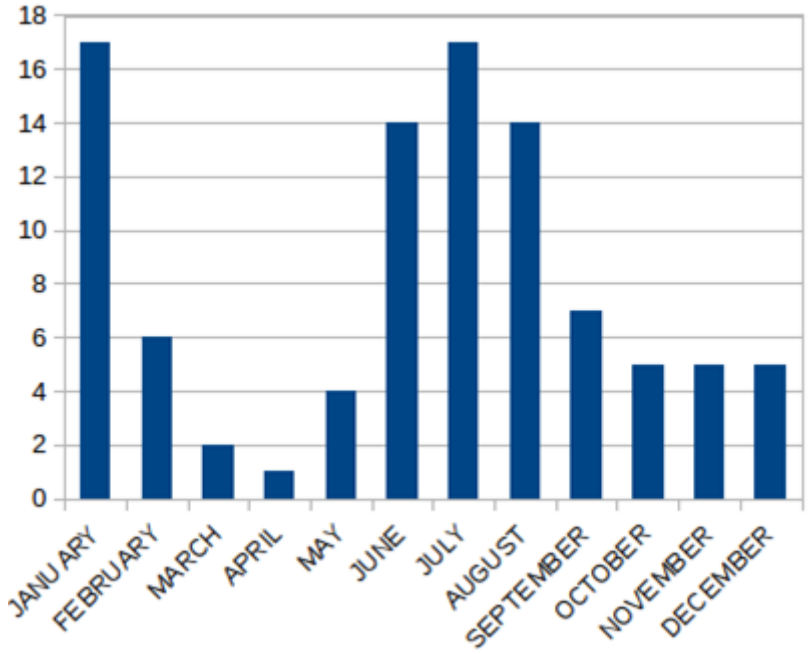
The age range was 10 to 79 years with maximum (38%) cases occurring in the age group of 16-30 years. The age group distribution was 0-15 (9%), 16-30 (38%),31-45 (22%),46-60 (19%) and above 60 years (12%). Age wise distribution of Dengue seropositive cases were shown in table 2. Most of the dengue studies done in India shows younger population predominantly involved(PM Ukey *et al*., 2010; Jayashree *et al*., 2011; Ashwini Kumar *et al*., 2010; Pruthvi *et al*., 2012).[(23,24,25,26)]

Table -2: Age distribution of Dengue seropositive

Age group	Number of Patients	Percentage
0-15	09	09%
16-30	37	38%
31-45	21	22%
46-60	18	19%
>60	12	12%
Total	97	100%

In this prevalence study it reveals that the incidence of Dengue fever is high in the month of January, July, June and August. From a total of 97 dengue seropositive cases 34 cases were reported in the month of January (17) and July (17). Followed by 28 Dengue seropositive cases in the month of June (14) and August(14). It depicts that the breeding increase more during monsoon season. But in summer season ,the occurrence of Dengue declined sharply. In the month of September there were 7 cases reported from Kannur district. 6 Dengue seropositive in February, each 5 cases in October, November and December followed by 4 from May, 2 and 1 seropositive cases from the month of March and April respectively. Month distribution of Dengue seropositive cases were shown in table 3.

Table -3: Month distribution of Dengue seropositive cases



There are certain crucial factors that influences the Dengue epidemic transmission across the country .That includes climate condition ,landscape, environmental factors and coastal area with high density population. In recent times, there has been a wide spread urbanization in Kerala. All these condition provides a suitable environment for breeding and abundance of Aedes mosquito species, thereby increasing the incidence of Dengue fever or Dengue haemorrhagic fever. Kerala is having the temperature range of 22 to 31^0c, relative humidity of 70% to 90% and rain fall. There are 2 major rainy seasons in Kerala. The south west monsoon arrives during the month of June and North west monsoon in mid October .The common breeding habitats of Aedes aegypti were cement cistern, cement tank, mud pot, flower pot, plastic container ,aluminium vessels that contained stagnant water.

Currently there is no effective and safe vaccine available against dengue fever. It is essential that adequate source reduction activity with community participation is the utmost important remedy for the prevention and control of Dengue. Proper solid waste disposal and improved water storage practices including covering containers to prevent access by laying female mosquitoes. Small mosquito eating fish have also been used with some success.

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