



International Journal of Mosquito Research

ISSN: 2348-5906
CODEN: IJMRK2
IJMR 2023; 10(6): 08-13
© 2023 IJMR
<https://www.dipterajournal.com>
Received: 09-08-2023
Accepted: 11-09-2023

K Yerrilakshmi
Child Development,
Project Officer, ICDS Project,
Dharmavaram, Sri Sathya Sai,
Andhra Pradesh, India

Dengue hemorrhagic fever in children: Risk factors and dengue virus serotype distribution in Dharmavaram revenue subdivision, Sri Sathya Sai District, Andhra Pradesh, India

K Yerrilakshmi

DOI: <https://doi.org/10.22271/23487941.2023.v10.i6a.711>

Abstract

The viral infection known as dengue hemorrhagic fever (DHF) continues to be a problem for public health. In the Sri Sathya Sai district's Dharmavaram revenue subdivision, the highest case fatality rate (CFR) was noted. Children who have dengue fever have an increased risk of dying. The increasing frequency of dengue fever necessitates research into three risk factors: the environment, mosquitoes as the vector, and humans as the host. This study uses a cross-sectional study design and a descriptive methodology. From August to December 2021, information was gathered using primary data in the form of questionnaires. 90 children (48 with dengue and 42 control group) under the age of 18 who met the criteria in the working area's Dharmavaram revenue subdivision served as the study's subjects. The univariate analysis of the data was done using a frequency distribution table. The results of this study show that male children between the ages of 10 and 15 are the ones who experience dengue fever in the workplace the most. Based on other host factors, children who are active outside the home and seldom use repellent are more likely to contract dengue fever. Dengue fever patients have a habit of draining the landfill once every two weeks, never closing the landfill, and never recycling used items, according to Mosquito Nest Eradication Behaviours. Most kids with dengue fever hardly ever hang their clothes up in their rooms or use abatements. Residents of the Dharmavaram revenue subdivision were more likely to contract dengue if they used insect repellent, hung their garments outside, or had larvae in their water containers. The most common serotype of dengue virus is DEN-1. Environmental management encourages intervention against the *Aedes aegypti* mosquito, a carrier of dengue fever, as well as other environmental changes. We believe that the outcomes of this study will shed light on vulnerable populations and serve as a platform for future research.

Keywords: Dharmavaram revenue subdivision, case-control study, dengue fever, risk factors, serotypes, dengue virus

Introduction

India has a tropical environment, which supports the growth of vectors that spread infectious diseases. The disease dengue hemorrhagic fever (DHF) is one that is still prevalent in India ^[1]. This severe viral illness is brought on by the dengue virus. This virus belongs to the Flavivirus genus of the Flaviviridae family and has four serotypes, namely (DEN-1, -2, -3, and -4). It is a positive-strand RNA virus ^[2]. He possesses the dengue virus. There are several other mosquitoes that can be vectors of dengue fever, namely the *Aedes Polynesiensis*, *Aedes Scutellaris* and *Aedes Albopictus* mosquitoes, but these types are found less frequently. The dengue virus causes this disease, which is spread by mosquitos, particularly *Aedes aegypti*. Dengue fever will often grow every year during the rainy season. Humans as hosts, mosquitos as transmission vectors, and environmental variables all have a role in the spread of dengue disease ^[3].

The high prevalence of dengue fever cannot be separated from the imbalance between causal factors originating from the infectious vector (mosquito), host (human), and the environment. Immune state is one of the host factors that determines the occurrence of dengue fever, which is the defence in a person's body that influenced by age, gender, type of infection, and nutritional status. According to research by Marón in 2010 ^[4].

Corresponding Author:
K Yerrilakshmi
Child Development,
Project Officer, ICDS Project,
Dharmavaram, Sri Sathya Sai,
Andhra Pradesh, India

Dengue cases occur more often in children under 15 years of age and children with higher nutritional status will suffer more severe symptoms if they contract dengue fever. The results of this research are in line with research in the district in Maneerattanasak *et al.* (2020) [5], most dengue fever cases occurred in children under 15 years of age with a death rate reaching 90%. Apart from that, there are also environmental factors that influence the presence of infectious vectors. These factors consist of temperature, climate, high population density and mobility, clean water facilities that do not meet the requirements, as well as unfavourable community behaviour [6].

According to the Ministry of Health, India, as of August 2021, the number of dengue fever sufferers was 1.64 lakhs cases with less than 1% deaths (CFR; 0.7%) [7]. Sri Sathya Sai district is one of the endemic areas in Andhra Pradesh. Every year there are always cases of dengue fever and every year there are also deaths due to this disease. Data from the Health Service in 2011 there were 108 cases, Incidence Rate (IR) 1.15 per 10,000 population with the death of 2 sufferers, in 2012 there were 110 cases, IR 1.18 (CFR 1.82%) with deaths of 2 patients, and in 2013 there were 296 cases, IR 3.13 deaths of 3 patients (CFR 1.01%). Every year there is an increase in the number of residents of Dharmavaram revenue subdivision, Sri Sathya Sai district who are infected with DHF, in 2009-2021, the prevalence of dengue fever increased on average by 80% cases. Until now, there is no specific treatment for DHF. Maintaining the patient's body fluid volume is very important and is given according to the phase of the disease, and in accordance with the hematocrit value guidelines. If it has reached severe dengue fever, medical treatment must be handled by doctors and nurses who are experienced in this disease. With treatment from competent health personnel, it can save lives and reduce the death rate from 20% to less than 1% [8].

Around 30% - 50% of DHF sufferers experience shock and end in death if treatment is inadequate. Complications can occur in dengue sufferers, namely Dengue Shock Syndrome (DSS) where electrolyte balance such as hyponatremia, hypocalcemia and overhydration can cause congestive heart failure and/or pulmonary edema which can lead to death. The death rate for DHF in children reaches up to 5% who die due to infection and depends on the availability of supportive and appropriate care [9]. The prevalence of DHF is affected by factors such as nutritional status, age, the presence of a vector, domicile, environment, breeding location, resting place, habit of hanging clothes, temperature, The use of anti-mosquito medication, occupation, knowledge, attitudes, and 3M practices.

Another type of supplemental prophylaxis used in this anti-dengue campaign is to sprinkle larvicide powder in difficult-to-clean water reservoirs. It's crucial to cease leaving clothes draped inside because this creates a breeding environment for mosquitoes, making it a mosquito breeding ground. Bed nets can be used to keep mosquitoes away, and the lighting and ventilation systems of the house can be modified to increase illumination and get rid of dampness. Fish that have been

developed to swallow mosquito larvae can be kept as pets. Plants that repel mosquitoes can be positioned inside and outside the home [10].

The dengue fever is widespread in India and predominantly affects people under the age of 18. There are numerous potential causes of dengue fever. The causes of DHF in children in the working area of the Dharmavaram revenue sub-division need to be described in more studies. If we can get rid of the disease's causes in this way, we can lower the number of dengue fever cases and fatalities, thereby minimizing health burden in Sri Sathya Sai district, especially Dharmavaram. This research aims to identify risk factors for dengue fever, measure environmental characteristics and vector density, analyze dengue virus serotypes, analyze environmental factors and community behaviour regarding the incidence of dengue fever in children.

Materials and Methods

This research design uses a descriptive method with a cross sectional and observational analytic using the Case - Control approach. This research was conducted in the selected loctions in Dharmavaram revenue sub-division (Figure 1) work Area in August – December 2021 by taking primary data, namely questionnaires. Sampling with criteria for respondents with dengue disease who are hospitalized according to WHO criteria. Researchers visited respondents' homes to measure environmental risk factors, namely area altitude, water pH, air temperature, air humidity, larvae density / Container Index (CI). Researchers also observed behavioural risk factors, namely the habit of hanging clothes, the habit of using mosquito repellent and the habit of napping. The subjects in this study were children under 15 years of age who met the criteria, namely (1) residing in the working, (2) the respondent's parents agreed to take part in the research, and 3) respondents agreed to take part in the research. The case sampling technique was taken. The case sampling technique was taken using purposive sampling. The number of subjects in this study was 90 people. The interview questions asked of the research subjects are listed in the questionnaire which has been validated previously. The data obtained will be processed using SPSS program. Data were analysed univariately by describing the frequency, proportion, or percentage of risk factors for dengue fever in the host and environment in a population. In this research, the frequency of each variable will be presented in the form of a frequency distribution table

Location of the study

The Sri Sathya Sai district is located in Andhra Pradesh. It has a population of 1.72 million and covers 7,771 km. The 2011 census found that 13.53% of the population were Scheduled Castes (SCs) and 4.56% were Scheduled Tribes. Dharmavaram is a town in the Sri Sathya Sai district. In 2011, it had a population of 121,874. The literacy rate was 71%, which is slightly lower than the national average of 73%. Tribes make up 4.56% of the population in the Sri Sathya Sai district [11].

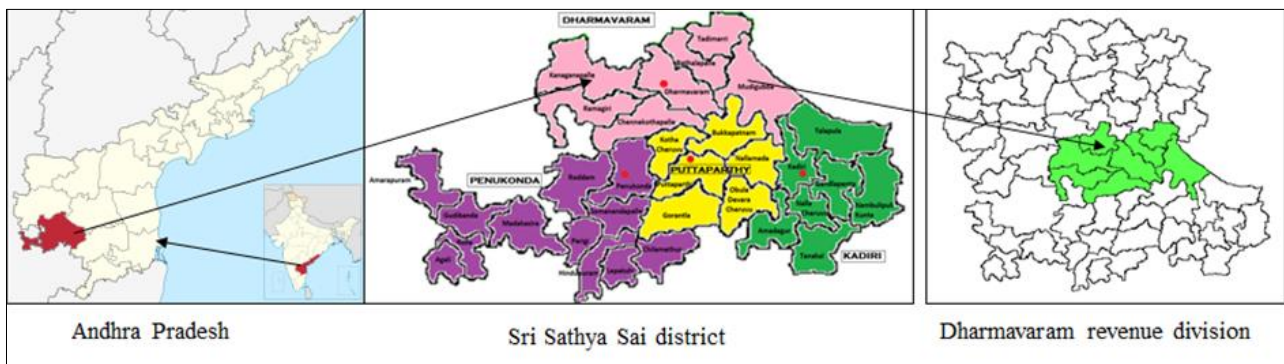


Fig 1: Location mapping of the study area

Results

Basic Characteristics of the Sample: Research respondents were children under 15 years of age who lived in the working

area of the Dharmavaram revenue subdivision with the characteristics listed in Table 1.

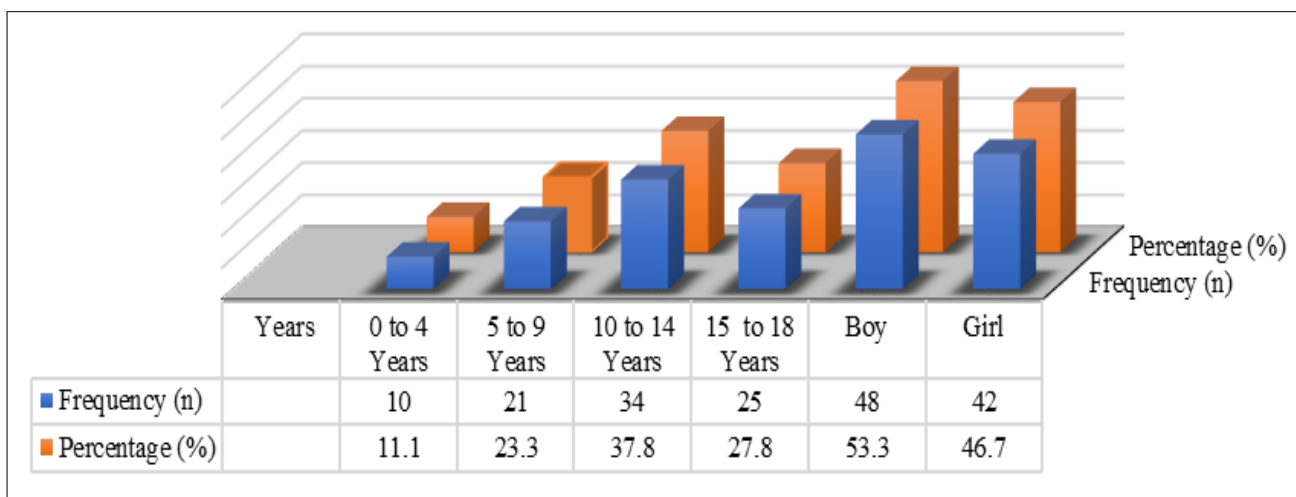


Fig 2: Characteristics of respondents in the study

In this research, it was conducted on children under 18 years of age who live in the working area of the Dharmavaram revenue subdivision with a total of 90 respondents.

Table 2: Distribution of Risk Factors in Children for the Occurrence of DHF

Risk Factors	Dengue fever		No dengue fever	
	N = 48	%	N = 42	%
Age (Years)				
0 – 4	3	6.25	7	16.67
5 – 9	12	25	9	21.42
10 – 14	17	35.42	17	40.49
15 - 18	16	33.33	9	21.42
Jenis Kelamin				
Law - Law	28	58.33	20	47.62
Woman	20	41.67	22	52.38
Children's Activities Outside the Home				
Low	0	0	15	35.71
Medium	15	31.25	20	47.62
High	33	68.75	7	16.67
Use of Repellent				
Always	1	2.08	2	4.76
Infrequently	37	77.09	24	57.15
Never	10	20.83	16	38.09

Based on age, the 10-14-year age group is the age group most affected by dengue fever and it is more common in boys, namely 28 people. Based on the habits of activities carried out by children outside the home, most of the children who were sick with dengue fever had a high level of activity outside the home, namely 33 people. Meanwhile, based on the use of repellent, most of the children with dengue fever had the habit of using repellent infrequently, namely 37 people.

Description of Environmental Risk Factors for DHF in Children in the Working Area of the Dharmavaram Revenue Subdivision

Based on the 3M behaviour (Draining, closing water reservoirs (DCW), and recycling used goods), children who are sick with dengue fever mostly occur in families who have the habit of draining the DCW every 2 weeks, never closing the DCW, and never recycling second-hand. In this study, most people directly through their rubbish into shelters and it was picked up by environmental cleaners. Based on the use of abate, it was found that children who were sick with dengue fever mostly occurred in families that rarely used abate (68.75%) and children who did not have dengue fever occurred in families that always used abate as many as 2 people (4.77%).

Table 3: Distribution of risk factors in the environment for the Occurrence of DHF

Risk Factors	Dengue fever		No dengue fever	
	N = 48	%	N = 42	%
Landfill Draining Habits				
< Once Every 1 Week	1	2.09	20	47.62
Once every 2 weeks	46	95.82	7	16.67
>2 Weeks	1	2.09	15	35.71
The habit of closing Landfills				
Always	0	0	9	21.42
Infrequently	16	33.33	21	50
Never	32	66.67	12	28.58
The habit of recycling used goods				
Always	1	2.09	8	19.05
Infrequently	23	47.91	27	64.28
Never	24	50	7	16.67
Use of Abate				
Always	0	0	2	4.77
Infrequently	33	68.75	31	73.81
Never	15	31.25	9	21.42
The habit of hanging clothes				
Never	6	12.5	3	7.15
Infrequently	31	64.58	23	54.76
Always	11	22.92	16	38.09

In this study, it was found that children who were sick with dengue fever mostly occurred in families with the habit of rarely hanging clothes in the children's room, namely 31 people (64.58%). Meanwhile, there were 3 children who were not sick with dengue fever who had the habit of never hanging

clothes in the children's room.

Identification of dengue virus types

Based on the data obtained from the primary health centres in the study area (Dharmavaram revenue subdivision), the distribution of the most common serotype is DEN-1 which is found in West Bathalapalli, C.K.Palli. Tadimarri and Rapphadu mandals. Serotype DEN-2 is found in Mudigubba, C.K Palli, Kanaganapalli, Ramagiri, Tadimarri and DEN-3 is also found in West Bathalapalli, Dharmavaram, Mudigubba, C.K Palli, Kanaganapalli, Ramagiri, Tadimarri and Rapphadu and serotype DEN -4 was not found. Several other studies related to the distribution of this serotype stated that four dengue virus serotypes were found. The most dominant serotype in each city is different, serotypes DEN-1, DEN-2 & DEN-3 are the most dominant in circulation while DEN-4 is the least serotype. The population of Dharmavaram revenue subdivision has high mobility, many people travel to highly endemic areas, so the risk of getting dengue infection from these four serotypes is greater. In fact, a person can experience dengue virus infection from more than 1 serotype throughout his or her lifetime. Infection with one serotype will provide lifelong immunity against the same serotype, but will not provide cross-immunity against other serotypes^[12].

Table 4 displays the results of a Chi-Square test for independence and dependence, with a significance level of $p < 0.05$ indicating a significant association between the independent and dependent variables, and the OR value providing insight into the strength of the association.

Table 4: Recapitulation of the relationship between risk factor variables and the incidence of dengue fever

Factor Risk	OR	CI 95%	P-Value	Information
Area Height	1	0.301 – 3.321	1	Not Significant
Water pH	0.6	0.291 – 1.365	0.327	Not Significant
Air temperature	2	1.679 – 2.475	0.475	Not Significant
Humidity	4.2	1.629 – 11.207	0.004	Significant
Flick Density	3.8	0.766 – 19.972	0.164	Significant
Water Storage Sites (TPA) are snapping	8.8	3.615 – 21.423	0.001	Significant
Respondents' habits of using anti-mosquito medicine/repellent	6.1	2.602 – 14.502	0.001	Significant
Nap Habits	1	0.469 – 2.575	1	Not Significant
Habit of hanging clothes	8.3	3.219 – 21.886	0.001	Significant

The results of bivariate analysis on environmental risk factors showed that altitude (OR: 1.000, p : 0.840), air temperature (p : 0.161) and pH of water in mosquito breeding places (OR: 0.630, p : 0.327) were not significant. Air humidity (OR: 4.2, p : 0.004) analysis results showed significant results. The need for high humidity influences mosquitoes to look for damp and wet places as a place to perch or rest.

At humidity less than 60%, the mosquito's lifespan will be shorter so that the mosquito cannot become a vector because there is not enough time for the virus to move from the stomach to the salivary glands. With the lowest humidity of 71.9% to 83.5%, it indirectly provides the opportunity for mosquito longevity to be longer for the virus growth cycle in its body. Various literature studies have identified that the incidence of dengue fever is closely related to air humidity.

The analysis of larval density yielded non-significant results (OR: 3.8, p : 0.164). However, the presence of larvae in landfills showed a significant relationship (OR: 8.8, p : 0.0001) with the incidence of dengue fever. This indicates that individuals with water reservoirs containing larvae have a risk 8.8 times higher than those without larvae in their water

reservoirs, as determined by the statistical findings.

Discussion

In this study, the 10 - 14-year age group was the largest age group who experienced DHF, namely 17 people. This is in accordance with research at Gambiran Regional Hospital, Kediri City in 2017, children aged < 15 years more often suffer from dengue fever. Children are more susceptible to dengue fever because children of this age have capillary blood vessel endothelium which is more susceptible to the release of cytokinin^[13].

The incidence of dengue fever in the Dharmavaram revenue subdivision work area is more common in boys than girls. This is similar to the results of research regarding the characteristics of dengue fever at Lee *et al.*^[14] pointed out that dengue fever occurs more often in boys. This is because girls are more efficient in producing immunoglobulins and antibodies compared to boys.

In this study, most of the children who were sick with dengue fever had high levels of activity outside the home, namely 33 people (68.75%). This result is supported by the results of

research conducted by Medagama in 2020 ^[15] which states that someone with high activity outside the home has a 1.66 times greater risk of experiencing dengue fever than someone with low activity outside the home. This shows that dengue fever transmission does not only occur inside the home but can occur outside the home.

Based on the use of anti-mosquito lotion (repellent), the incidence of dengue fever in children mostly occurred in children who rarely used repellent, namely 37 people (77.09%). The results of research conducted by Yoon et al (2019) ^[16] stated that the use of anti-mosquito lotion (repellent) had an effect on the incidence of dengue fever in children. The way to avoid mosquito bites is to cover your skin with anti-mosquito lotion (repellent). The quantity of anti-mosquito lotion used is greatly influenced by the content of the anti-mosquito lotion. In Indonesia, several plant extracts are used as ingredients in repellents. Apart from plant extracts, there are also several synthetic insecticides used to control mosquitoes, namely organophosphates, carbamates and pyrethroids ^[17].

One way to physically control mosquitoes is to implement the 3 M behaviour (draining and closing the landfill, and recycling used goods). According to research by Istiqomah ^[18], children whose families have the habit of draining landfill at home more than once every 2 weeks have a 10,947 times greater risk of contracting dengue fever. Water reservoirs must be drained at least once a week to prevent the availability of breeding places. *Aedes aegypti* mosquito so that it can control the density of *Aedes aegypti* mosquito larvae. Closing landfills at home such as jars, drums, etc. is done to prevent mosquitoes from laying eggs in the landfill so as to reduce the presence of dengue vectors ^[19]. The habit of closing landfills aims to reduce the number of mosquitoes that lay their eggs in the landfill. Recycling used items that have the potential to hold water is one of the primary ways to prevent dengue fever and is part of 3M's behaviour which is part of the government's dengue prevention program.

The use of larvicide powder is a form of chemical vector control. Chemical vector control is the most frequently used control method in the community, namely the use of larvicide powder. Larvicide powder is a class of chemical insecticides for controlling dengue fever targeting pre-adults (larvae) ^[20]. The *Aedes aegypti* mosquito likes clothes that are already used and hanging as a resting place because human sweat sticks to clothes that contain amino acids, lactic acid or other substances that mosquitoes like. So, when used clothes are hung up, it will increase the population of adult mosquitoes living in the house.

Climate is a risk factor for dengue fever. Environmental climate factors will influence vector survival. An increase in rainfall and temperature of 0.5 °C will have a big influence on the number and population of mosquitoes. In places with high humidity, the eggs will hatch more quickly and develop into mosquitoes as vectors for dengue fever. The rainfall factor has a relationship closely related to the rate of increase in the *Aedes aegypti* mosquito population. Rainfall can increase the number of vector breeding places (breeding places) or can also eliminate brooding places.

The results of this research are in accordance with the research of Huang *et al.* ^[21], which states that there is a relationship between mosquito breeding sites with high numbers of dengue fever incidents in Kaohsiung City with a value of $p = 0.017$ (OR = 5.373). This is also in line with

research from Pham HV, *et al.* (2011) which states that the presence of a reservoir of water that is flickering is associated with the incidence of dengue fever (RR=1.78). The respondent's habit of sleeping during the day (OR: 1.0, p : 1.000) means that it is not statistically significant. The habit of using mosquito repellent or repellent (OR: 5.4, p : 0.036), which means that the habit of not using mosquito repellent/repellent has a risk 5.4 times greater than the habit of using mosquito repellent/repellent. The variables included in the multivariate analysis are variables that are theoretically thought to be related to the incidence of dengue fever, and statistically have a significance of less than 0.25. Based on bivariate analysis, there were 5 variables with $p < 0.25$, namely: Indoor air humidity, density of larvae, water reservoirs containing larvae, habit of using mosquito repellent and habit of hanging clothes.

The results of the multivariate analysis showed that the most dominant independent variables were, respectively: water reservoirs that flickered, indoor air humidity, the habit of using mosquito repellent and the habit of hanging clothes.

Conclusion

The incidence of dengue fever in children who live in the working area of the Dharmavaram revenue subdivision is more common in the age group 10-14 years, and is male. Based on their habits, most children who are sick with dengue fever have a lot of activity outside the home and rarely use repellent. Meanwhile, based on 3M's behaviour in families, children with dengue fever are more common in families who have the habit of draining the landfill once every 2 weeks, never closing the landfill, and never recycling used goods. Apart from that, children who are sick with dengue fever mostly occur in families with the habit of rarely using abates and rarely hanging clothes in the child's room.

Based on the findings and deliberations, the following conclusions can be drawn.

- There are three distinct forms of dengue virus serotype distribution in the Dharmavaram revenue subdivision: Den-1, Den-2, and Den-3. According to laboratory investigation using PCR, DEN-1 is the most prevalent.
- Altitude, water pH, and air temperature do not have a significant impact on the incidence of dengue fever. However, air humidity is significantly related to the occurrence of dengue fever.
- The density of larvae is not a significant risk factor, but the presence of larvae in water reservoirs is significantly associated with the incidence of dengue fever.
- The behaviour of individuals who take naps does not have a significant impact, whereas the use of mosquito repellent has a significant relationship with the occurrence of dengue fever.

Suggestion

1. With the distribution of DEN-1, DEN-2 and DEN-3 viruses in Dharmavaram revenue subdivision, it is hoped that medical officers will be careful about the secondary dangers of different serotypes because they can result in more severe disease manifestations.
2. For the community to clean vector breeding places, eliminate natural breeding places and adopt the habit of not hanging clothes and using anti-mosquito medication/repellent.
3. For the Health Service and Community Health Centers or

related agencies to prevent dengue fever by eradicating the *Aedes* sp vector in a selective, integrated manner and conducting studies and research on dengue fever in collaboration with the world of education, research and development.

References

- Gupta E, Ballani N. Current perspectives on the spread of dengue in India. *Infect Drug Resist.* 2014 Dec 11;7:337-42.
- Gubler DJ. Dengue and dengue hemorrhagic fever. *Clin Microbiol Rev.* 1998 Jul;11(3):480-96.
- Trivedi S, Chakravarty A. Neurological Complications of Dengue Fever. *Curr Neurol Neurosci Rep.* 2022 Aug;22(8):515-529.
- Marón GM, Clará AW, Diddle JW, Pleités EB, Miller L, Macdonald G, Adderson EE. Association between nutritional status and severity of dengue infection in children in El Salvador. *Am J Trop Med Hyg.* 2010 Feb;82(2):324-9.
- Maneerattanasak S, Suwanbamrung C. Impact of nutritional status on the severity of dengue infection among Paediatric Patients in Southern Thailand. *Pediatr Infect Dis J.* 2020 Dec;39(12):e410-e416.
- Caminade C, McIntyre KM, Jones AE. Impact of recent and future climate change on vector-borne diseases. *Ann N Y Acad Sci.* 2019 Jan;1436(1):157-173.
- The Economic Times, India reported 1.64 lakh dengue cases during 2021 against 2.05 lakh cases in 2019: Govt to Rajya Sabha
<https://economictimes.indiatimes.com/news/international/uae/discover-dubais-entrepreneurial-spirit-in-the-latest-episode-of-live-work-and-play-in-dubai-with-co-founder-of-meril-aquaponics-rohit-bachani/articleshow/104562815.cms>
- Madanayake P, Jayawardena A, Wijekoon SL, Perera N, Wanigasuriya J. Fluid requirement in adult dengue haemorrhagic fever patients during the critical phase of the illness: an observational study. *BMC Infect Dis.* 2021 Mar 20;21(1):286.
- Rajapakse S. Dengue shock. *J Emerg Trauma Shock.* 2011 Jan;4(1):120-7.
- Rather IA, Parray HA, Lone JB, Paek WK, Lim J, Bajpai VK, Park YH. Prevention and Control Strategies to Counter Dengue Virus Infection. *Front Cell Infect Microbiol.* 2017 Jul 25;7:336.
- District Census Handbook – Anantapur" (PDF). Census of India. p. 14,46. Retrieved 18 January 2015.
- Cogan JE, WHO. Dengue and Severe Dengue. World Health Organisation. 2020.(1):2-3.
- Jayani I, Fadilah C. Nutritional Status is related to the Clinical Degree of Dengue Hemorrhagic Fever (DHF) Infection. *Nursing Sciences Journal.* 2019;1(1):1-10.
- Lee MS, Hwang KP, Chen TC, Lu PL, Chen TP. Clinical characteristics of dengue and dengue hemorrhagic fever in a medical center of southern Taiwan during the 2002 epidemic. *J Microbiol Immunol Infect.* 2006 Apr;39(2):121-9.
- Medagama A, Dalugama C, Meiyalakan G, Lakmali D. Risk Factors Associated with Fatal Dengue Hemorrhagic Fever in Adults: A Case Control Study. *Can J Infect Dis Med Microbiol.* 2020 Apr 30;2020:1042976.
- Yoon JK, Kim KC, Cho Y, Gwon YD, Cho HS, Heo Y, *et al.* Have potential as repellents in Indonesia. *Spiracles.* 2019;11(1):24-33.
- Istiqomah M. Risk Factors for Dengue Hemorrhagic Fever (DHF) in Children under 15 years of age (Study in Putat Jaya Village, Surabaya City): Airlangga University; c2016.
- Rima BK. Factors Associated with the incident of dengue hemorrhagic fever in Plembang Hamlet, Balerejo District, Madiun Regency: Stikes Bhakti Husada Mulia; c2017.
- <https://ncvbdc.mohfw.gov.in/WriteReadData/1892s/guidelines%20for%20treatment%20of%20Dengue.pdf>
- Huang CH, Lin CY, Yang CY, Chan TC, Chiang PH, Chen YH. Relationship between the Incidence of Dengue Virus Transmission in Traditional Market and Climatic Conditions in Kaohsiung City. *Can J Infect Dis Med Microbiol.* 2021 Aug 9;2021:9916642.