Journal Health of Indonesian
Volume 3, Number 01, January 2025 (No 33-41)
DOI 10.
E.SSN 2987-0313 (Online)

Optimizing Environmental Sanitation as an Effort to Control Dengue Fever (DBD) Vectors

Saskia Diah Nisa
Program Studi Kesehatan Masyarakat Fakultas Farmasi Dan Ilmu Kesehatan Universitas sari Mutiara Indonesia

Article Info
Corresponding Author:
Saskia Diah Nisa
E-mail:
saskiadiah2@gmail.com

ABSTRACT

Dengue Hemorrhagic Fever (DHF) is an endemic disease caused by dengue virus infection transmitted through the main vector, the Aedes aegypti mosquito. Transmission of this disease is influenced by environmental factors, human behavior, and inadequate sanitation conditions. This article aims to discuss effective environmental sanitation management in suppressing the Aedes aegypti vector population and preventing the spread of DHF. Several aspects analyzed include the provision of clean water, the habit of hanging clothes, management of water reservoirs (TPA), the condition of trash bins, and the presence of pots or other containers that have the potential to become mosquito breeding grounds. Good environmental management, such as the application of the 3M method (Draining, Covering, and Recycling), the use of larvicide, and routine cleaning of places that have the potential to become mosquito nests, has been proven to be able to significantly reduce vector density. In addition, planning vector eradication through abatization and fogging methods in densely populated areas is also a strategic step in reducing DHF cases. By increasing public awareness of the importance of environmental sanitation, it is hoped that dengue virus transmission can be minimized, so that extraordinary events (KLB) of DHF can be prevented.

Keywords:
Dengue Fever, Aedes aegypti, environmental sanitation, vector management, disease prevention

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is one of the serious public health problems in Indonesia. This disease is caused by the dengue virus which is transmitted through the bite of the Aedes aegypti mosquito as its main vector. Based on data from the Ministry of Health, DHF cases tend to increase every year, especially in tropical areas with environmental conditions that support the development of mosquitoes. The impact is not only on individual health but also on the economic and social burden of society.

Poor environmental and sanitation conditions are the main factors that accelerate the spread of dengue fever. Stagnant water, garbage accumulation, and people's habits that are less concerned about environmental cleanliness provide an ideal place for mosquitoes to breed. This shows the importance of environmental sanitation management as a preventive measure to reduce the incidence of dengue fever.

DHF prevention efforts have been carried out through various programs such as mosquito nest eradication (PSN), community education, and fogging. However, the

effectiveness of these programs still often faces obstacles such as lack of public awareness, minimal resources, and less than optimal program sustainability. Therefore, a more systematic and participatory approach is needed in environmental sanitation management.

This study aims to analyze effective environmental sanitation management strategies in preventing DHF. By utilizing qualitative descriptive methods, this study is expected to be able to provide comprehensive solutions and applicable recommendations in environmental management so that it can help reduce the prevalence of DHF in Indonesia.

METHOD

This study uses a qualitative descriptive method to analyze environmental sanitation management in preventing Dengue Hemorrhagic Fever (DHF). Data were obtained through literature studies, interviews with environmental health experts, and direct observation in several DHF endemic areas. The research steps include:

1. Primary and Secondary Data Collection
    a. Primary data: Direct observation of environmental conditions, including water reservoirs, trash bins, community habits, and the potential for puddles of water to become nests for Aedes aegypti mosquitoes.
    b. Secondary data: Literature study of scientific articles, health reports, and government documents related to the mosquito nest eradication (PSN) program.
2. Identification of Risk Factors Identifying environmental risk factors that contribute to increasing mosquito vector populations, such as sanitation quality, environmental cleanliness, and community behavior.
3. Environmental Sanitation Management Strategy Analysis Analyze the effectiveness of various environmental management strategies, including:
    a. Implementation of the 3M Plus method (Draining, Covering, Recycling, and adding actions such as the use of larvicide).
    b. Counseling the community about the importance of maintaining environmental cleanliness and how to break the chain of dengue fever transmission.
    c. Evaluation of mosquito nest eradication programs that have been carried out, such as fogging and abatization.
4. Evaluation and Recommendations The collected data were analyzed using a qualitative approach to develop recommendations for effective sanitation management. The results of the study are expected to be a guide for the community and government in designing sustainable dengue prevention programs.

RESULTS AND DISCUSSION

Environmental Sanitation

Understanding Environmental Sanitation

Sanitation according to the World Health Organization (WHO) is an effort to monitor several physical environmental factors that affect humans, especially those that affect the effects, damage physical development, health, and survival, environmental sanitation is the health status of an environment that includes housing, waste disposal, provision of clean water and so on, Environmental sanitation management that can be applied in the community in order to reduce the source of Aedes Aegypti larval habitat, including:

Clean Water Provision

For humans, the need for water is absolute because almost all human activities require water. In addition to the large amount or volume of water needed by humans to meet their living needs. The change of season from dry to rainy season is a vulnerable point for the explosion of dengue fever cases, especially supported by the availability of clean water such as rainwater that can accommodate puddles. This effort can suppress the population of Dengue Fever (DBD) mosquitoes during the peak season, so that outbreaks or extraordinary events of Dengue Fever (DBD) can be avoided.

In the working area of the Medan Polonia District Health Center, clean water supplies are usually stored in different water reservoirs made from various materials such as cement or ceramic tubs, and plastic drums. The provision of clean water is highly dependent on local culture and water needs. For example, in the Medan Polonia city area, the provision of clean water from rainwater is collected for water reserves for watering plants in the yard while water from the Regional Drinking Water Company (PDAM) is for other purposes. Aspects of environmental sanitation in controlling Dengue Hemorrhagic Fever (DHF) vectors include clean water storage.

Hanger or stack of cloth

The relationship between the habit of hanging clothes with the presence of Dengue Fever (DBD) vectors. There are 4 types of surfaces that are preferred as resting places for mosquitoes, namely cement, wood, clothing, and metal surfaces. Male mosquitoes are more often found resting on metal surfaces, while female mosquitoes are more often found on wood and clothing surfaces. It also shows a relationship between the habit of hanging clothes with the endemicity of Dengue Fever (DBD). PSN activities using the 3M method plus avoiding the habit of hanging clothes indoors are activities that must be carried out to control the population of Aedes Aegypti mosquitoes, so that the transmission of Dengue Fever (DBD) can be prevented and reduced. (Pratiwi Dyah, 2013).

Water Reservoir (TPA)

In the Medan Polonia health center work area where there is a piping system, there is still a tendency to store water, because water from the piping does not flow at times. The condition of water storage provides opportunities and chances for the occurrence of Aedes Aegypti mosquito breeding grounds. Dengue Hemorrhagic Fever (DHF) is influenced by the density of the disease vector. through monitoring of the TPA. that the number of DHF cases in an area is influenced by the presence of Aedes Aegypti larvae in water reservoirs, especially those used for human needs. The existence of this water reservoir is related to the presence of larvae.

Furthermore, environmental sanitation is something that must be considered by residents of Medan Polonia District. That every environment that has a large number of TPAs has a greater risk of suffering from Dengue Hemorrhagic Fever (DHF) compared to environments that have a small number of TPAs. Breaking the chain of transmission by mosquito vectors can be done by avoiding or reducing contact with mosquitoes, killing mosquito larvae and eliminating mosquito breeding places. (Azlina et al., 2016)

Trash Can Condition

The condition of the open trash bin will cause water to pool in it caused by splashes of rainwater, and the trash bin that is not covered will be used by mosquitoes as a breeding ground. The trash bin that is located very close to residential areas, so that with the close distance of the breeding ground and the house, it is easy for these mosquitoes to reach the

residential area to survive. The existence of trash bins that are always open can be connected to the managementPoor waste management is thought to be the cause of trash bins becoming breeding grounds for Aedes Aegypti mosquitoes.

Efforts to eradicate Dengue Hemorrhagic Fever (DBD) in the community must continue to pay attention to the possibility of trash bins as breeding grounds for Aedes Aegypti mosquitoes. Trash bins should not be left open.and waste transportation must run well. (Riandi et al., 2017)

Presence of Pots/Containers

The existence of ornamental plants in the form of pots can be a place for mosquitoes to breed. Used cans, bird drinking places, water storage drums, stone basins, and bamboo are places that can hold stagnant water. Factors that determine the occurrence of dengue fever outbreaks are unclean yard environments, flower pots, stagnant water in various places, garbage, especially used tires, coconut shells, pieces of bamboo, drums, used cans, bottles that can hold water for a long time (Daryono, 2004).

That Aedes aegypti mosquitoes can breed in used cans, bird drinking places and ornamental plant pots. The existence of ornamental plant pots in the environment, especially ornamental plants that use water as a medium for growth, in reality there are puddles of water. This puddle is used as a breeding place for Aedes Aegypti mosquitoes. By paying attention to the cleanliness of ornamental plant pots. The increasing production of these items has resulted in an increase in discarded items such as used tires, cans, broken glass and plastic. These used items all provide opportunities for increasing breeding of Aedes Aegypti mosquitoes. . With efforts to clean the surrounding environment carried out by the community, it is hoped that it can reduce cases and transmission of dengue fever. (Azizah et al., 2018).

Dengue Hemorrhagic Fever (DHF) Vector

Understanding Dengue Fever Vectors

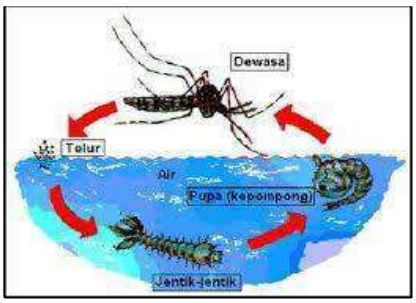
Aedes aegypti and Aedes albopictus are vectors that transmit dengue fever. These vectors, biologically and bionomically, are always close and related to human life, to control the Aedes aegypti population is mainly done through environmental management. Factors that cause the re-emergence of the dengue epidemic include: human population growth, unplanned and uncontrolled urbanization, solid waste management that is not good and correct, inadequate provision of clean water, increased spread of mosquito vectors, ineffective mosquito control, increased spread of the dengue virus and deteriorating infrastructure in the field of public health.

Environmental sanitation management that can be applied in the community in order to suppress the source of Aedes Aegypti larval habitat. Among others: improving the provision of clean water, improving the habit of hanging or stacking cloth, improving Water Reservoirs (TPA), improving the condition of trash bins, and improving the existence of pots/containers. Such activities can be applied in places where dengue disease is endemic, Ministry of Health of the Republic of Indonesia (2000).

Morphology of Aedes Aegypti Mosquito

Adult Aedes Aegypti mosquitoes are smaller in size compared to other mosquitoes on average. These mosquitoes have a black base with white spots on their bodies, legs, and wings. Male Aedes Aegypti mosquitoes suck plant fluids or flower nectar for their living needs, while females suck blood. Female mosquitoes prefer human blood to animal blood. Usually female mosquitoes look for their prey during the day. Biting activity is usually in the

morning (9:00-10:00) until the evening (16:00-17:00). Aedes Aegypti has a habit of sucking blood repeatedly to fill its stomach with blood. (Suyasa et al., 2012)



Morphological description of female Aedes mosquitoes (Riandi et al., 2017)

Adult Mosquito

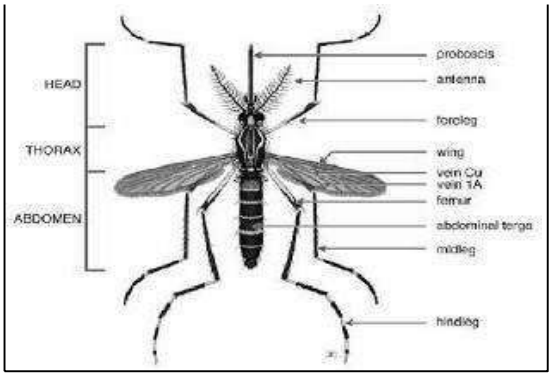


Figure 1. Image of a female Aedes mosquito (Riandi et al., 2017)

According to the Directorate General of PPPL (2014:30-31) states that in general the Aedes mosquito consists of three parts, namely the head, Thorax, and Abdomen, has two pairs of wings and three pairs of legs. Adult Aedes mosquitoes are medium-sized with a black body with white spots. The body and hands are covered with scales with white spots. Aedes. aegypti on the back of its body appears two curved vertical lines on the left and right sides are white, while Aedes. Albopictus on the back of its body appears one thick straight white line.

Egg

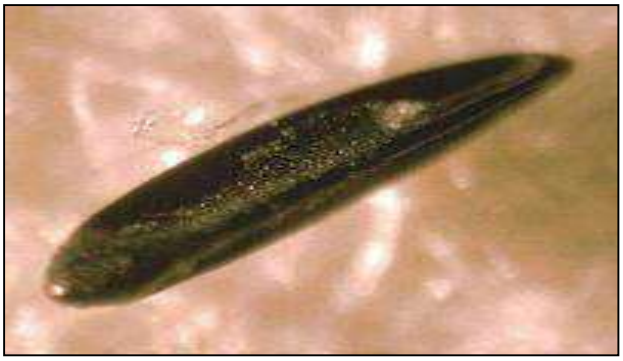


Figure 2. Morphology of Aedes eggs (Riandi et al., 2017)

Eggs are laid one by one on the surface of the water, usually on the inner wall of the container on the surface of the water. The number of mosquito eggs for one laying can reach 300 grains with a size of ± 5 mm. The eggs are elliptical in shape, black in color and separate from each other. In poor conditions (in long dry season conditions), eggs can survive for more

than a year. The eggs will hatch into larvae 7 after 1-3 days submerged in water (Directorate General of PPPL, 2014: 29).

Larvae

Figure 3 Larvae of Aedes aegypti (Riandi et al., 2017)

Larvae After the eggs are submerged for 2-3 days, they hatch into larvae. Larvae experience 4 levels or stages called instars, namely instars I, II, II, and IV. The growth time of each stage is instar I larvae for 1 day, instar II larvae for 1-2 days, instar II larvae for 2 days, instar IV larvae for 2-3 days. Aedes larvae in water can be recognized by the characteristics of measuring 0.5-1 cm and always moving actively in water. When resting, their position is almost perpendicular to the surface of the water to breathe (get oxygen). Furthermore, the larvae develop into cocoons (Directorate General of PPPL, 2014:29)

Aedes Aegypti Pupa

Figure 4 Aedes aegypti pupa (Riandi et al., 2017)

The mosquito is very effective as a disease transmitter. After sucking blood, the mosquito perches (rests) inside or outside the house. The preferred perching places are hanging objects and usually in dark and damp places. The mosquito waits for the maturation process of its eggs, then the female mosquito lays her eggs on the wall of the breeding place, slightly above the water surface. Generally, the eggs will hatch into larvae within 2 days after being submerged in water. The larvae then become pupae and finally become adult mosquitoes. (Suyasa et al., 2012).

Transmission Mechanism of Dengue Hemorrhagic Fever (DF)

Dengue hemorrhagic fever is transmitted by the Aedes Aegypti mosquito. The mosquito gets the dengue virus when it bites and sucks the blood of a person who is sick

with dengue hemorrhagic fever or is not sick but has the dengue virus in their blood. A person whose blood contains the dengue virus is a source of transmission of dengue fever.

The dengue virus is in the blood for 4-7 days starting 1-2 days before the fever. If the sufferer is bitten by an infectious mosquito, the virus in the blood will be sucked into the mosquito's stomach. The virus willmultiplythemselves and spread throughout various tissues of the mosquito's body including in its salivary glands. Approximately 1 week after sucking the blood of the sufferer, the mosquito is ready to transmit it to others (extrinsic incubation period). The virus will remain in the mosquito's body throughout its life, therefore, the aedes aegypti mosquito that has sucked the dengue virus becomes a transmitter (infective) throughout its life. This transmission occurs because every time the mosquito stabs/bites, before sucking blood it will secrete saliva through its piercing tool (proboscis) so that the blood that is sucked does not clot. It is with this saliva that the dengue virus is transferred from the mosquito to another person. (Masriadi, 2017)

Consequences of Dengue Virus Transmission

If the dengue virus enters the human body, specific anti-substances will be formed according to the type of dengue virus that has entered. The signs or symptoms that arise are determined by the reaction between substances in the body and antigens in the newly introduced dengue virus. People who contract the dengue virus for the first time generally only suffer from dengue fever or a mild fever with non-specific signs/symptoms or even show no signs of illness at all (asymptomatic).

Dengue fever sufferers usually recover on their own within 5 days without treatment. The sign of dengue hemorrhagic fever is sudden fever lasting 2-7 days. The fever can go down on the 3rd day and then rise again, and on the 6th day the fever suddenly goes down, if the person has previously been exposed to the dengue virus (Masriadi, 2017)

Vector Eradication Planning

Four principles in making vector eradication plans, namely:

1. Taking advantage of seasonal changes in mosquito conditions due to natural influences, by carrying out vector eradication when dengue fever cases are at their lowest.
2. Breaking the cycle of transmission by maintaining vector density at a low level to allow patients during the viremia period to recover on their own.
3. Striving to eradicate vectors in all areas with high transmission potential, namely densely populated areas with quite high mosquito density.
4. Efforts to eradicate vectors in distribution centers such as schools, hospitals, and surrounding buffer areas. Eradication Vector can be carried out at the adult stage or the larval stage. (Masriadi, 2017)

Vector Eradication is divided into two, namely:

Eradication of Adult Stage Vectors

Eradication of dengue fever vectors during an outbreak is often done by fogging or spraying the home environment with insecticide.malathion aimed at adult mosquitoes. The method is by spraying or fumigating using a fumigation machine that can be done by land or air. Several studies have shown that fumigation of houses with malathion is very effective for vector eradication.

However, if this activity is not supported by the application of abatization, in a few days the density of adult mosquitoes will increase again, because the larvae that are not killed by fumigation will become adults, in eradicationadult vector stages need to be accompanied by abatization. (Masriadi, 2017).

Eradication of Vector Larvae Stage

Eradication of the larval stage vector can be done using insecticides or without insecticides.

1. Eradication of Larvae with Insecticides
   Insecticides used to eradicate Aedes Aegypti larvae are called larvicides, namely Abate (temephos). Abate SG 1% is known as the safest larvicide compared to other larvicides, with WHO recommendations for use as a killer of mosquito larvae that live in the population's drinking water supply, so that its activities are often called abatization. Its use is at a dose of 1 ppm (parts per million),that is every 1 gram of Abate 1% for every 10 liters of water. Abate after being sprinkled into the water, with some still remaining in the water. The purpose of abatization is to suppress the vector density as low as possible simultaneously in a longer period of time, so that dengue virus transmission during that time can be reduced. While the function of abatization can be as a supporter of fogging activities carried out together, also as an effort to prevent the eruption or increase in DHF sufferers. (Masriadi, 2017).
2. Eradicating Larvae Without Insecticides
   How to eradicate the vector larval stage without using insecticidesbetter known as mosquito nest cleaning (PSN). This activity is a sanitation effort to eliminate unused containers, so as not to provide an opportunity for Aedes Aegypti mosquitoes to breed in the container.
   Actions to clean mosquito nests include regularly draining water containers once a week, tightly closing clean water containers, and burying used containers such as used cans, plastic cups, and other used items that can hold rainwater so that they become...mosquito nests (known as the “3M” action (Masriadi, 2017).

REFERENCES

Azizah, F. N., Hermawati, E., Susanna, D., Lingkungan, D. K., Masyarakat, K., & Masyarakat, B. K. (2018). Menguras dan menutup sebagai prediktor ke- beradaan jenti k pada kontainer air di rumah Cleaning and closing as predictors of the presence of larvae in water container at home. *Berita Kedokteran Masyarakat*, *34*(5), 242–247.

Azlina, A., Adrial, A., & Anas, E. (2016). Hubungan Tindakan Pemberantasan Sarang Nyamuk dengan Keberadaan Larva Vektor DBD di Kelurahan Lubuk Buaya. *Jurnal Kesehatan Andalas*, *5*(1), 221–227. https://doi.org/10.25077/jka.v5i1.472

Darmalaksana, W. (2020). Metode Penelitian Kualitatif Studi Pustaka dan Studi Lapangan. *Pre-Print Digital Library UIN Sunan Gunung Djati Bandung*, 1–
6. http://digilib.uinsgd.ac.id/32855/1/Metode Penelitian Kualitatif.pdf Iman Muhammad. (2014). *Pemanfaatan SPSS Dalam Penelitian Bidang Kesehatan Dan Umum* (3rd ed.).

Made, L., Yati, C., Prasetijo, R., Luh, N., & Sumadewi, U. (2020). Hubungan Sanitasi Lingkungan Dengan Keberadaan Jentik Nyamuk Terhadap Kejadian DBD di Desa Kesiman Kertalangu Kecamatan Denpasar Timur. *Higinene*, *6*(1), 37–42.

Masriadi. (2017). *Epidemiologi Penyakit Menular* (R. Pers (Ed.)). *ME R : ME*. (n.d.).

Pratiwi Dyah, M. C. (2013). Pengelolaan Limbah Medis Padat Pada Puskesmas Kabupaten Pati Tahun 2013. *Universitas Negeri Semarang, Indonesia*, 183.

http://journal.unnes.ac.id/nju/index.php/kemas

Riandi, M. U., Hadi, U. K., & Soviana, S. (2017). Karakteristik Habitat dan Keberadaan Larva Aedes spp. pada Wilayah Kasus Demam Berdarah Dengue Tertinggi dan Terendah di Kota Tasikmalaya. *ASPIRATOR - Journal of Vector-Borne Disease Studies*, *9*(1), 43–50. https://doi.org/10.22435/aspirator.v9i1.5849.43-50

Suliyanto. (2017). Pelatihan Metode Pelatihan Kuantitatif. *Journal of Chemical Information and Modeling*, *5*(2), 223–232.

Suyasa, I., Adi Putra, N., & Redi Aryanta, I. (2012). Hubungan Faktor Lingkungan dan Perilaku Masyarakat dengan Keberadaan Vektor Demam Berdarah Dengue (DBD) di Wilayah Kerja Puskesmas I Denpasar Selatan. *Ecotrophic, Journal of Environmental Science*, *3*(1), 1–6.

WULAN, A. I. S. (2005). *Kualitas Air Bersih Untuk Pemenuhan Kebutuhan Rumah Tangga Di Desa Pesarean Kecamatan Adiwerna*.

Zulkarnaini, Siregar, Y. I., & Dameria. (2012). Hubungan Kondisi Sanitasi Lingkungan Rumah Tangga Dengan Keberadaan Jentik Vektor Dengue Di Daerah Rawan Demam Berdarah. *Jurnal Ilmu Lingkungan*, *vol.2 No 3*, 115–124. http://ejournal.unri.ac.id/index.php/JIL/article/view/324