GOVERNMENT OF THE PUNJAB
DENGUE FEVER AWARENESS CAMPAIGN

1. INTRODUCTION

Dengue is a mosquito-borne viral infection in human beings. In a few years' time, it has become the most rapidly spreading international public health problem, particularly in urban and semi-urban areas of tropical and sub-tropical regions of the world. More than 50 million people are in contact with the disease each year. This disease had also been known as break-bone fever.

1.1 Etymology (Origin of the Name)

Name of the disease, most probably, is derived from a Swahili word "***Dinga***" which means "evil spirit", Swahili is spoken in many East and North African countries. "***Dengue***" is a Spanish word meaning careful. It might have been used because a person suffering from severe pain in bones and joints moves carefully.

1.2 Classification of the Disease: The disease has four types:

1.2.1 Undifferentiated fever: where very mild symptoms like flue, cold or negligible fever occurs.

1.2.2 Dengue Fever (DF): with clear symptoms of high fever, headache, severe pain in joints and rashes on skin etc.

1.2.3 Dengue Hemorrhagic Fever (DHF): It involves high fever with spontaneous bleeding from capillaries.

1.2.4 Dengue Shock Syndrome (DSS): More serious symptoms of high fever and shock, very low blood pressure, weak pulse (difficult to detect).

2. HISTORY OF DENGUE

The first reported epidemics of dengue fever occurred in 1779-1780 in Asia, Africa, and North America almost simultaneously. At that time, dengue virus and vector mosquitoes had a worldwide distribution in the tropics and subtropics. *Aedes aegypti* was identified as a vector of dengue virus in 1905. A global pandemic of dengue began in Southeast Asia after World War II. It has intensified during the last two decades in many countries. Sri Lanka, India, and Maldive Islands had their first major DHF epidemics in 1980s.

In Pakistan, cases of dengue fever were first reported in 1994 from Karachi. Since then its victims are increasing in different regions of the country. In 2011, situation has become alarming in Lahore.

Note: English teacher can take help of science teacher if required

3. SYMPTOMS

Among the people infected with dengue virus about 80% have only mild symptoms of uncomplicated fever. When mild undifferentiated symptoms appear without any rash, it can be misdiagnosed as flu or some other viral infection. Less than 5% have severe illness which may be life threatening in a small proportion.

The common symptoms of dengue fever usually appear within 4-7 days after infection. These may include high fever, chill, rash, severe headache especially behind the eyes. Dengue is named "break-bone fever" due to severe muscle and joint pain. Other symptoms are dizziness, fatigue, weakness, loss of appetite, nausea, persistent vomiting and backache. However, symptoms vary from person to person.

3.1 Phases of Symptoms

The course of infection is divided into three phases: febrile phase, critical phase and recovery phase (Fig. 1).

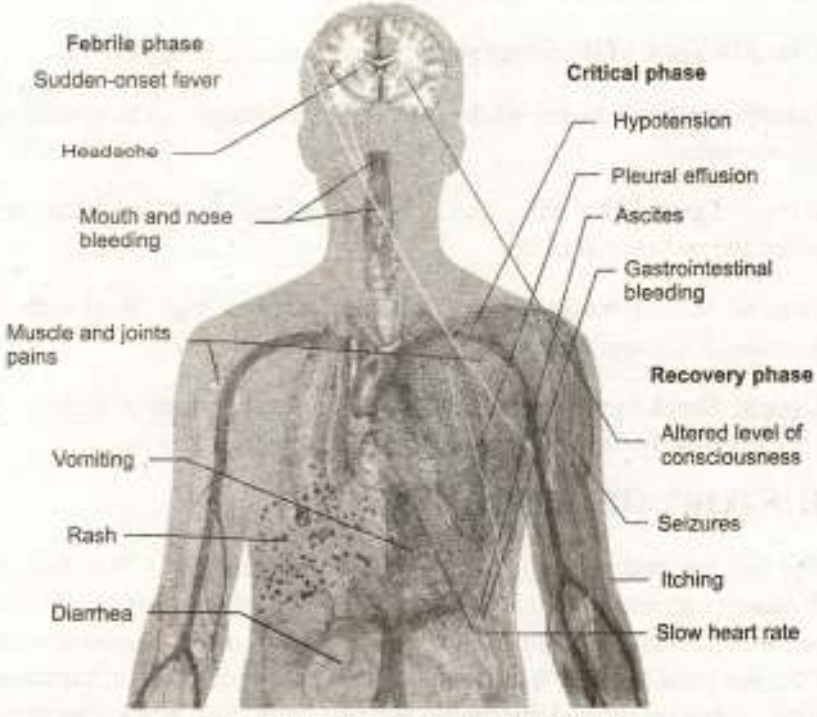

Fig1. Symptoms of dengue fever

3.1.1 Febrile Phase

It usually lasts for 2-7 days from the beginning of the illness. In this phase the temperature of the patient may rise above 102°F, with generalized pain and headache. Some

patients may have sore throat. It is difficult to distinguish dengue from non-dengue in early febrile phase. A positive tourniquet test increases the probability of dengue. Rash appears in 50-80 % patients, initially as flushed skin but after 4-7 days as measles like rash. When skin is pressed capillaries are broken, tiny red spots **(petechiae)** appear on skin (Fig. 2). Mild bleeding may occur from nose and gums. In some patients gastrointestinal bleeding also occurs. The liver often enlarges after a few days. The number of platelets and white blood cells progressively decreases. After about 2-3 days the symptoms of the disease subside, fever drops and the patient sweats profusely.

Fig 2: Petechiae on skin

3.1.2 Critical Phase

In some cases the disease moves to a critical phase. It usually lasts for 1-2 days. The temperature drops to normal on day 3-7 of illness. The permeability of capillaries increases. Fluid/plasma leaks for 24-48 hours and accumulates in the chest and abdominal cavities. Platelet level further decreases. It increases the leakage of plasma from the blood capillaries. This leads to decrease of fluid in circulation, hence decrease of blood supply to vital organs (liver, kidney, heart, brain etc.). It may cause organ dysfunction, severe bleeding, low heart rate and low blood pressure.

Dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) occur in less than 5 % of cases. Dengue hemorrhagic fever is characterized by high fever, headache, small purplish spots on skin due to leakage of blood from capillaries, abdominal pain, vomiting with blood due to bleeding in stomach. People with low immunity or with secondary infection are at greater risk of developing DHF. A small proportion of DHF cases may lead to dengue shock syndrome. DSS can damage body organs like heart and kidney due to low blood supply.

3.1.3 Recovery Phase

Recovery phase lasts for 2-3 days. During this phase reabsorption of leaked fluid into the blood stream takes place. Appetite returns, bleeding, nausea and vomiting decrease, large urine output occurs; plasma level is restored, white blood cells and platelets start increasing. Fever and other symptoms rarely last for more than seven days.

3.2 Comparison with Malaria

Features	Malaria	Dengue Fever
Mosquito	*Anopheles*	*Aedes aegypti*
Infectious organism	*Plasmodium*	*DEN virus*
Symptoms	• Severe chills with goose flesh and shivering with high fever. • General headache • Fever becomes normal by profuse sweating after a specific time (3-4 hours) but if not treated, it occurs again after an interval depending upon the life cycle of *Plasmodium* (usually 48 hours). • No muscle and joint pain. • No rash on the body • No leakage of fluid / plasma from blood capillaries.	• High fever and chill. • Headache especially behind the eyes • High fever which become normal after 2-7 days and no recurrence of fever. • Severe muscle and joint pain. • Rashes on the body. • Leakage of fluid/plasma from the blood capillaries.
Habitat	*Anopheles* prefer to live outdoors and dirty water.	*Aedes* prefer to live close to human habitat in urban areas particularly indoors.
Time of attack	*Anopheles* is mostly active at night.	Day time aggressive biter with feeding peaks of two hours before and after dawn and dusk.
Primary and secondary attack	Primary infection cannot induce life long protective immunity. Secondary infection is not severe than primary infection.	Primary infection can induce life long protective immunity to the infecting serotype. Secondary infection by some other serotype is severe than primary infection.
Treatment	Bed rest, sponging and anti malarial drugs	Bed rest, sponging, rehydration (more fluid intake), anti pyretic drug preferably Paracetamol

4. CAUSATIVE AGENT

Dengue fever is caused by dengue virus (DEN).

4.1 Structure of Dengue Virus

This tiny creature contains all information for its horrible mode of attack on poor patient (Fig. 3).

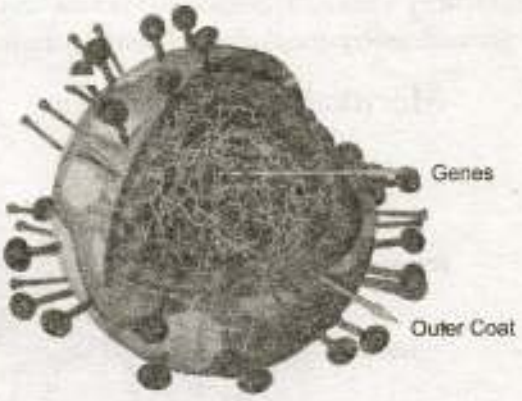

Fig.3: Structure of dengue virus

4.2 Serotypes of Dengue Virus

Dengue Virus (DEN) has four distinct serotypes, known as DEN-1, DEN-2, DEN-3 and DEN-4. Any of the four serotypes can cause severe and fatal disease. There are some variants of each serotype, which may have greater epidemic potential.

5. TRANSMISSION OF DENGUE VIRUS

Dengue virus is transmitted by the bite of infected female of *Aedes* mosquito. It can also be transmitted by infected blood products and through organ transplant. The life cycle of the dengue virus involves mosquito as a vector and human beings as a host.

5.1 Stages in Human Being

Man is the primary host and can be infected by a single bite of infected *Aedes*. After getting entry into the human blood stream through the mosquito's saliva, the virus attacks and reproduces in various target cells, in skin, lymph nodes and liver. New viruses attack white blood cells to further increase in number. WBCs produce a number of proteins, responsible for many of the symptoms such as fever, flu and severe pains.

5.2 Stages in *Aedes* Mosquito

Mosquitoes are important vectors of human and animal diseases. *Aedes aegypti* and *Aedes albopictus* are considered as vectors of dengue virus in Pakistan. The male mosquitoes of all types feed only on plant juices while females, in addition to plant juices, may feed on blood. It needs blood proteins to produce eggs. Without blood meal it cannot lay eggs. *Aedes* female generally acquires the virus by feeding on the blood of an infected person. Virus replicates within its body. It then moves to the mosquito's salivary glands where it continues to replicate. Life cycle in the mosquito usually completes within 8-10 days, depending upon suitable environmental conditions, especially temperature. The virus seems to have no harmful effect on infected mosquito, which can transmit the virus to human beings during blood meal. Infected female may also transmit the virus to its next generation through her eggs.

In Pakistan three main groups of mosquitoes, i.e., *Aedes*, *Anopheles* and *Culex* predominate. Only their females serve as vector for a number of pathogens (disease causing

organisms). Viruses of dengue and yellow fever are transmitted by *Aedes*; malarial parasite (*Plasmodium*) by *Anopheles* and filarial parasites, which cause elephantiasis by *Culex*.

6. Morphology of Mosquito

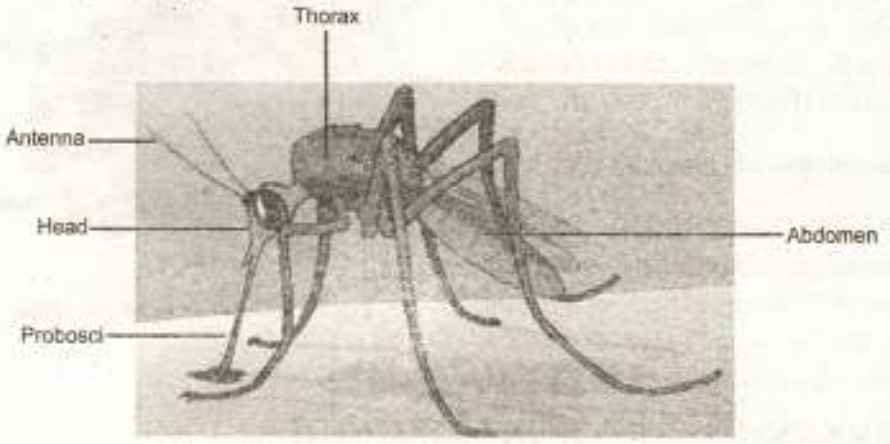

Fig. 4. General structure of a mosquito

7. LIFE CYCLE OF *Aedes* MOSQUITO

Water is necessary for all mosquitoes to complete their life cycle. Their development shows **complete metamorphosis** with four stages; egg, larva, pupa, and adult (Fig. 5). The first three stages occur in water while adult stage can fly in air freely. The life span from egg to adult takes about one to six weeks, depending upon the availability of food, optimum temperature and humidity. The most favorable temperature is 28°C with 80% humidity.

7.1 Egg

Aedes mosquitoes prefer to lay eggs on rough and moist surfaces. The eggs of *Aedes* are black in color and oval in shape (0.5 mm in length). They are shielded by a rigid shell having minute pores for gas exchange. Each female can lay eggs upto 5 times in her life and the number of eggs varies from 50 to 300 eggs. Eggs of *Aedes* remain dormant in winter and can withstand drying up to one year. They can hatch when water is available.

7.2 Larva

Exposure to high humidity at the water line for 2-3 days is required for larva to hatch from the egg. Larva has a well-developed head with mouth brushes for feeding, a large thorax, a long abdomen and has no legs. The posterior part of the abdomen has four lobed gills and a shorter air tube (siphon) used for breathing. They actively feed on bacteria and tiny organic matter found in water. After replacing its covering four times, it becomes pupa within 2-4 days.

7.3 Pupa

Pupa is motile but does not feed at all. This stage ends by shedding of pupal case and emergence of adult within 1-2 days.

7.4 Adult

The newly emerged adult rests on the surface of the water for a short time to allow itself to dry and its parts to harden. The adult mosquito usually lives for 2-4 weeks.

8. DIAGNOSIS OF DENGUE FEVER

Early diagnosis is necessary for the accurate treatment and proper management of the disease. Nearest family physician must be contacted for his advice. Quacks and self-medication should be strictly avoided.

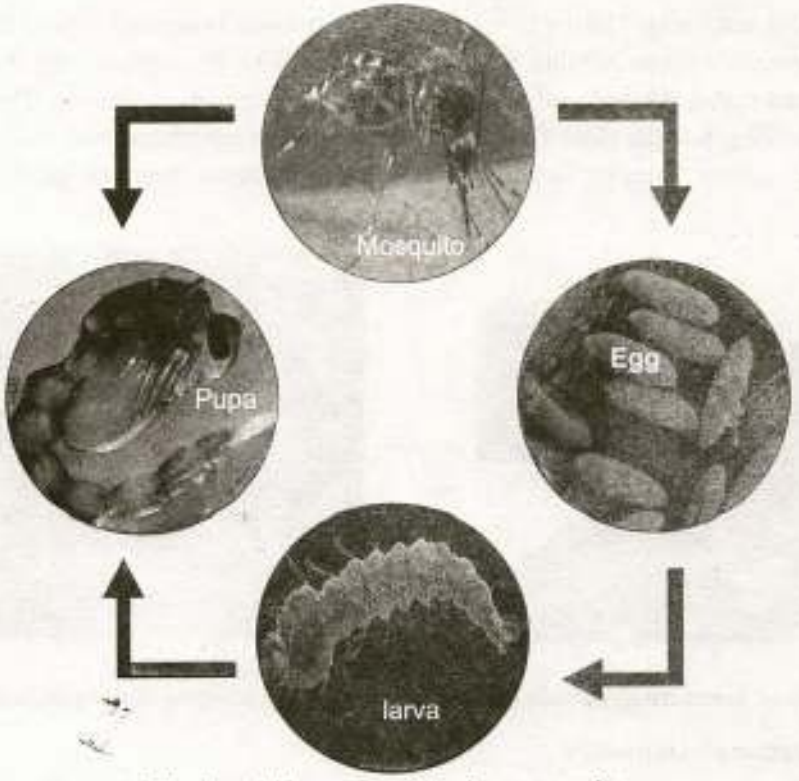

Fig. 5: Life cycle of *Aedes* mosquito

8.1 Laboratory Tests

Clinical tests are carried out on the advice of the physician for diagnosis of dengue fever.

8.1.1 Complete Blood Count (CBC)

It is a broad screening test for many diseases. Automated analyzer gives a profile of number of different types of WBCs (white blood cells), RBCs (red blood cells) and platelets per unit volume. Low WBC and platelet count may indicate dengue.

Table 1: Normal ranges of different types of blood cells

Type of cells	Normal Range
RED Blood Cells (RBCs)	3900000 - 5500000 / µl
White Blood Cells (WBCs)	4000 - 10000 / µl
Platelets	150000 - 450000 / µl

8.1.2 Tourniquet Test

For this test the cuff of the blood pressure instrument is applied around the arm, inflated to a pressure about 105 mm Hg (mm of mercury) for five minutes and then removed. Small round flat dark-red spots (petechiae) may appear on the skin. These are formed by bleeding into the skin. Their number ten or more per square inch indicates possible dengue fever. Number 20 or more confirms the Dengue Hemorrhagic Fever (DHF).

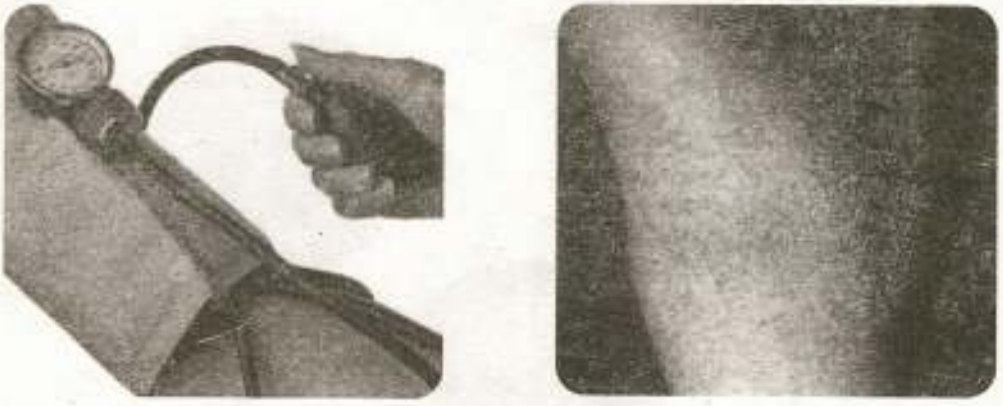

Figure 6. Blood pressure apparatus (left) and arm showing positive tourniquet test (right)

8.1.3 Detection of Antibodies

Certain antibodies produced in the human body in response to viral infection e.g., **Ig G and Ig M.** These antibodies can be detected around the fifth day of dengue onset.

9. MANAGEMENT STRATEGIES FOR THE DENGUE PATIENT

For the time being, no effective medicine is available for dengue fever. The World Health Organization (WHO) recommended that patient should be kept on supportive therapy.

9.1 Complete Bed Rest

Complete rest is advised by the physician. It is the most effective method for

controlling any kind of disease. Activity or anxiety uses body's energy. Patient should stay calm to cope with the disease more efficiently.

9.2 Sponging

In the case of high fever, body temperature should be kept below 102°F. Doctors advise that it may be lowered by sponging with moderately cold water.

9.3 Paracetamol

Paracetamol is the only effective drug advised to relieve fever and pain. Any other drug is strictly prohibited to avoid complications. Dose should be determined by a doctor.

9.4 Rehydration

Patient should increase fluid intake through fruit juices and ORS (Oral Rehydration Salt). It is very important to replace loss of fluid, sugar and electrolytes. Adequate fluid intake reduces the chance of hospitalizations.

9.5 Hospitalization

All patients need not to be hospitalized. They may be sent home by the physician after early diagnosis of mild symptoms. Most of the dengue patients can be treated as "out patients" and advised to immediately rush to hospital in the case of emergency.

9.6 Isolation of the Patient

Complete isolation of the patient is not required, however, use of mosquito net is mandatory so that a mosquito may not get virus from the patient. Hospital environment should be insect free.

9.7 Avoid Travelling

The patient should not travel to long distance to avoid spread of disease to other areas.

9.8 Platelet Transfusion

Platelet transfusion is not required in most of the cases. A qualified doctor regularly monitors the platelet count and decides the time for transfusion. Platelet transfusion from a suitable donor should be carried out under his supervision in a hospital. Proper screening and cross matching of donor and recipient is necessary. To facilitate the platelet transfusion, government has equiped major hospitals of the towns with **mega unit cell separators**. Concentrated form of platelets separated from single donor is called **mega unit of platelets**. These separators quickly isolate only the platelets and simultaneously return rest of the blood back to the donor.

10. PREVENTION

Presently there is no specific vaccine available for dengue fever. Therefore, the only choice left is to control the vector involved in the transmission of dengue virus. Control of mosquito also helps to control other diseases like malaria and yellow fever.

10.1 Protect People from Mosquito Bite

10.1.1 Use Bed Nets: Bed nets should be used to protect the people from mosquito bite. *Aedes* mosquito mostly bites during the day and *Anopheles* at night. Bed nets are more effective when they are treated with an insecticide or insect repellent.

10.1.2 Use Mosquito Repellent: Mosquito repellent in the form of body lotions may help avoid mosquito bite. Aerosol insecticides, vaporising mats and mosquito coils should be used in rooms. Curtains may also be sprayed with mosquito repellents.

10.1.3 Wear a Proper Dress: Minimise area of exposed skin by wearing full sleeve shirts and long pants. Wearing socks and closed shoes further reduces the risk. Mosquito repellent can also be applied to clothes for further protection. Avoid wearing dark and tight clothes, because mosquito attacks more on dark colours and can easily bite through tight clothes.

10.1.4 Screening of Houses, Offices etc: Screening of windows and doors with fine wire net bans entry of mosquitoes. Dengue patient should always be kept in screened room to avoid viral spread from the patient.

10.1.5 Reschedule Daily Activities: People should reschedule the pattern of daily activities of life. We should avoid going outside during the peak hours of mosquito activity. Moreover, we should avoid visiting areas of epidemics.

10.2 Vaccination

Vaccines are weak or killed germs, which when introduced in the body induce immunity against the healthy germs. Dengue vaccine is not yet available. A quadrivalent vaccine for all four dengue serotypes is still awaited.

10.3 Vector Control

10.3.1 Destruction of Breeding Sites

Aedes breed mainly in stagnant clean water bodies such as earthenware jars and domestic water storage tanks. But discarded plastic food containers, toys, old tyres, tree holes and leaf axils that can collect rain water, gutters and drains are also potential breeding sites. Following measures should be taken to destroy these breeding sites.

- Cover any water container.
- Remove any bottle, plastic bag, pot, old pan, tin and old tyre.

- Remove any water standing in lawn, flower beds and pots.
- Change water in vases/bowls, flower pots and plates on alternate days.
- Close and dry all swimming pools and fountains during breeding season of mosquito.
- Drain out or regularly change water from room cooler. Also drain out water coming out from air conditioners.

Fig. 7: Waste items and garbage which may become mosquito breeding site

- Cover all manholes.
- Water from pots for birds and animals should be replaced daily.
- Cover water tanks on roof.
- Repair all taps and pipes from where water is leaking out.
- Drain water after washing motor cycle and car etc.
- Change water regularly in fish aquarium.
- Drain any stagnant rain water, fill these sites with sand and soil.
- Remove trash from streams and drains.
- Clean toilet and gully trap every day.
- Turn over all water storage buckets and small tubs.
- Clear any blockage in roof drain pipes regularly.
- Remove water from leaf axils and tree holes or add some insecticides.

10.3.2 Control at Adult Stage

Chemical control: Adult mosquito can be killed by the use of insecticides. Insecticides should be used carefully. Avoid any direct inhalation of spray or smoke. Insecticides should be sprayed inside buildings, particularly on walls, behind the curtains, under the bed and sofa. Doors should be closed for some time after the spray. Fogging should be used to kill the mosquitoes in open places. Unwise use of insecticides may cause health hazards and may produce resistant strains of mosquitoes.

Fig 8. Fumigation and aerosol sprays

Use of electric mosquito killer: Different types of electric mosquito killers are used. These include electric vaporizer, electric mosquito trap, electric mosquito catcher, mosquito mat etc.

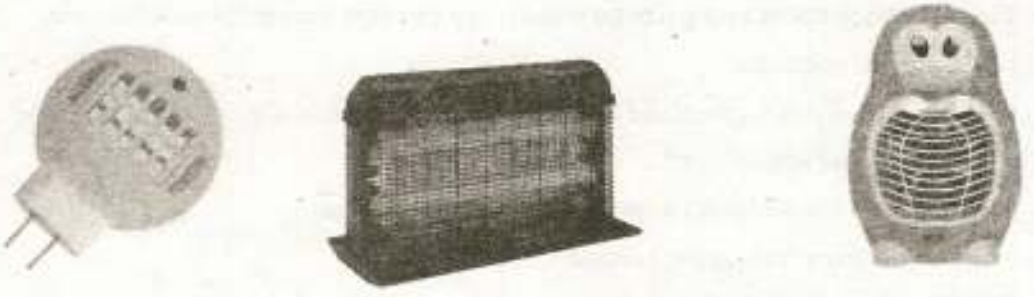

Fig 9: Electrical appliances for mosquito control

Biological control: Biological control should be adopted to avoid the harmful effects of chemicals. In biological control living organisms are used to kill the mosquitoes. Spiders, lizards and dragon flies are the natural predators of mosquito. Introduction of these organisms can markedly reduce the number of mosquitoes.

Horticulture Discipline: Regularly cut the grass and weeds where mosquitoes may hide.

10.3.3 Control at Larval Stage

Chemical control: Application of larvicidal chemicals to the breeding sites reduces the mosquito population. Spray of kerosene oil on water blocks the air tube/siphon of mosquito larvae and kills them, but these chemicals also destroy useful animal and plant life in water bodies.

Biological control: Living organisms can be used to destroy the mosquito larvae. Many

fishes and copepods predate upon mosquito larvae. A bacterium produces toxins which kill mosquito larvae. It can also be used for biological control.

10.3.4 Control at Egg Stage

We can destroy the eggs by using ovitraps. Ovitraps are black plastic water containers with paddles that are in contact with the surface of water. These ovitraps attract the female mosquito to lay eggs. In these ovitraps either the female is trapped or eggs are killed by chemicals mixed with water in ovitrap. Ovitraps should be used with care.

10.4 Integrated Disease Management

10.4.1 General Public Awareness for Civic Sense

A public awareness campaign for general cleanliness should be launched. The message for public awareness can be communicated by:

Mass Media: It includes radio, T.V., newspapers etc.

Educational Institutes: Teachers can develop awareness in students about the cause and prevention of the disease.

Mosques: Khateeb of mosque should create public awareness in mosques.

House to house campaign: Small committees should be constituted comprising students, teachers, social workers and peoples from civil society to visit door-to-door and create awareness about disease.

Posters and banners: Posters and banners should be displayed at prominent places in cities/towns highlighting the cause and prevention of the disease.

Seminars: Seminars and workshops should be arranged in educational institutes, public halls and theatres to create awareness in public regarding disease. Experts should be given this task.

10.4.2 Legislation

Laws should be formulated to punish and fine the persons/organizations involved in the spread of the disease. Legal action should be taken against them. Such complaints should be entertained on priority bases.

10.4.3 Collaboration among Organizations

Different organizations/departments of public and private sector doing efforts for the control and prevention of the disease should work in collaboration with each other. There should be active communication among policy makers, managers of the programs,

administrators and other key partners. An integrated and multidirectional disease control approach should be adopted.

11. RESEARCH

The scope of research is to develop effective methods of vector control, an ideal antiviral drug and development of vaccine for all sertotypes of dengue virus which is safe, effective and affordable.

12. GOVERNMENT'S RESPONSE:

Government of the Punjab has made tremendous efforts to control this epidemic. Special dengue wards are established in hospitals that are equipped with latest mega cell separators for platelet separation. CBC diagnostic camps are set up at different places in the city for diagnosis of dengue, free of cost. Experts from Sri Lanka, Indonesia and Thailand are requested to train special teams of doctors and paramedical staff to help combat this disease. Fogging machines and insecticides are imported. Students and teachers have participated in public awareness campaigns conducted through posters and pamphlets and seminars. Monitoring teams are given the task to inspect the level of cleanliness, public hygiene and sanitation. Regular feed back of all the efforts to control dengue are being presented to the Chief Minister on daily basis.

By the grace of Almighty Allah, out of about 7.4 million population of Lahore, only 365 deaths are reported till November 2011. These included deaths from not just complications of dengue but also co-morbidity (blood pressure, diabetes etc) and other infections in dengue patients.

EXERCISE

SECTION-I

Q. No. 1: Select the correct answer.

1: In a patient of dengue fever, fluid level in blood is generally

a) Increased b) Decreased

c) Stabilized d) Unchanged

2: Mosquitoes are involved in the spread of

a) Malaria b) Dengue

c) Yellow fever d) All of these

3: Dengue virus is spread by

a) *Culex* b) Flies

c) *Aedes* d) *Anopheles*

4: Dengue virus increases its number in

a) Skin cells b) Lymph nodes

c) WBCs d) All

5: Severe chill, shivering and recurring attacks are the characteristic symptoms of this disease

a) Dengue b) Tetanus

c) Malaria d) Pharyngitis

6: Paracetamol is a drug commonly used to

a) Kill DENV b) Kill mosquitoes

c) Relieve pain d) Kill *Plasmodium*

7: These are the substances produced by our immune system in the body in response to certain infections

a) Enzymes b) Antibiotics

c) Drugs d) Antibodies

8: Dengue disease spreads by the following process

a) Person to person by contact b) Through contaminated food

c) By mosquitoes d) All of these

SECTION – II

Q. No. 2: Give short answers of the following questions.

1: How is it possible to lower the body temperature of a patient without medicine?

2: If it is not possible to eliminate mosquitoes how can we avoid being bitten?

3: Define biological control, how this method can help control mosquitoes?

4: Define a disease vector; give a few examples of vectors.

5: Why is biological control more appreciated than insecticide sprays?

6: Is it wise to try to diagnose and treat a disease at home? Why?

7: How can dengue fever be differentiated from malaria?

8: In which areas mosquito born diseases are generally restricted? Why?

9: Name some common diseases which can be controlled by effective vaccination.

SECTION – III

Q. No. 3: Give elaborate answers

1: What are various possible means to check the mosquito growth?

2: What are possible symptoms of dengue as they may occur in different patients?

3: How should the government respond to any epidemic?

4: What should be the role of a community in case of a serious epidemic?

5: What types of laboratory tests are helpful in accurate diagnosis of the dengue?

SECTION IV ACTIVITIES

STUDENTS VISITS AND ASSIGNMENTS:

1. Visit the hospital of your area.

I. Observe the hygienic conditions of the hospital.

ii. Visit the dengue ward and observe the conditions in which the patients are kept and their way of treatment.

iii. Observe the different instruments installed in the hospital, such as megaseparater being used in disease management/treatment.

2. Visit the health institutes and note the measures taken by them to control the disease.

3. Visit different research centers and obtain the details of research going on dengue.

4. Visit diagnóstic laboratories and note tests for the diagnosis of dengue fever.

5. Make groups of 5-10 students and visit homes of different selected areas. Note the hygienic conditions and fill the performa designed for this purpose.

6. Visit the different industries and observe how do they dispose off the wastes.

7. Visit sewage disposal centers and observe how these centers dispose off the wastes.

8. Visit different forests and find the places where mosquitoes breed and live. Suggest different methods for their control.