CHAPTER II

LITERATURE REVIEW

2.1 Transmission of Dengue Virus

Dengue viruses are transmitted to humans through the bite of infected female *Aedes mosquitoes*. Mosquitoes generally acquire the virus while feeding on the blood of an infected person. After viral incubation for 8-10 days, an infected mosquito is capable, during probing and blood feeding, of transmitting the virus, to susceptible individuals for the rest of its life. The virus circulates in the blood of infected humans for two to seven days, at approximately the same time as they have fever; *Aedes* mosquitoes may acquire the virus when they feed on an individual during this period (WHO revised, 2002).

2.2 The Virus

Dengue viruses, single stranded RNA viruses of the family Flaviviridae, are the most common cause of arboviral disease in the world (9). There are four closely related, but antigenically distinct, virus serotypes namely DEN-1, DEN-2, DEN-3, and DEN-4. Infection with one of those serotypes does not provide cross-protective immunity, so persons living in a dengue-endemic area can have four dengue infections during their life times (CDC, 2001).

2.3 The Vector

The main vector of DHF in Thailand, as elsewhere in the WHO South-East Asia Region, is *Ae. aegypti*. *Ae. albopictus* is uncommon in Bangkok but its distribution and population begins to increase in the suburbs and is particularly high in rural areas. *Ae.*

aegypti was initially found mainly in urban areas but in the last decade it increased steadily in rural areas as well.

Aedes lays her eggs only in clean water. When freshly laid, the eggs are white but soon turn black in color. The young larvae soon cast their skin as they rapidly grow and reach the pupa stage. The pupae rise to the surface of water where the top of the pupal case opens and emerges the new adult (Mortimer, 1998).

Aedes breeds in water storage tanks/cisterns, drums, flower vases with water, potted plant with saucers, ornamental pools/fountains, roof gutters/sun shades, animal water containers, ant traps, used tyres, discarded large appliances, discarded buckets, tin cans, as well as in tree holes and rock holes (WHO, 1999).

Aedes is very domesticated and prefer human blood to animal blood. There are no intermediate vectors for dengue virus. It is a man-mosquito-man relationship. The virus remains in the salivary glands of the mosquito, and when she bites for food, she injects saliva into the wound where the anti-coagulants contained in her saliva facilitate feeding, at the same time, she also injects the virus into the host (Mortimer, 1998). This mosquito is a day-biter which rests indoor and is most active in the two hour period after sunrise and before sunset. (Australian Department of Health Ageing, 2001).

2.4 The Host

In humans, each of the four dengue virus serotypes has been associated with Dengue Fever and with DHF. Studies in Cuba and Thailand have shown a consistently high association between DEN-2 infection and DHF/DSS, but in the 1976 - 1978 Indonesia, 1980 - 1982 Malaysia, and 1989 - 90 Tahiti epidemics, and from 1983 onwards in

Thailand, DEN-3 was the predominant serotype recovered from patients with severe disease. In the 1984 Mexico, the 1986 Puerto Rico, and the 1989 El Salvador outbreaks, DEN-4 was most often isolated from DHF patients.

DSS occurs with higher frequency in two immunologically defined groups: children who have experienced a previous dengue infection, and infants with waning levels of maternal dengue antibody. The acute phase of infection, following an incubation of 3 - 14 days, lasts about 5 - 7 days and is followed by an immune response. The first infection produces life-long immunity to the infecting serotype but only temporary and partial protection against the other three serotypes, and secondary or sequential infections are possible after a short time. Transmission of dengue virus from infected humans to feeding mosquitoes is determined by the magnitude and duration of viraemia in the human host; persons with high viraemia provide a higher infectious dose of virus to the feeding mosquito, normally leading to a greater percentage of feeding mosquitoes becoming infected, although even very low levels of virus in blood may be infectious to some vector mosquitoes. (WHO, 1997).

2.5 Operational Definitions for Dengue Fever, Dengue Hemorrhagic Fever and Dengue Shock Syndrome (Pan American Health Organization, 2000)

2.5.1 Case Definition of Dengue Fever

An acute illness of 2-7 day duration with two or more of the following signs and symptoms: headache, retro-orbital pain, muscle pain, joint pain, rash, hemorrhagic manifestation, and leucopenia.

Laboratory Criteria for Diagnosis of Dengue Fever include one or more of the following:

- Isolation of dengue virus from serum, plasma, leucocytes, or autopsy samples.
- A four fold or greater change in reciprocal IgG or IgM antibody titres to one or more dengue virus antigens in paired serum samples by EIA.
- Detection of viral genomic sequences in autopsy tissue, serum or CSF samples by polymerase chain reaction.

2.5.2 Criteria for Dengue Hemorrhagic Fever

A case of dengue with hemorrhagic tendencies evidenced by one or more of the following:

- Positive tourniquet test
- Petechiae, ecchymoses or pupura
- Bleeding: mucosa, gastrointestinal tract, injection sites or other
- Haematemesis or melaena and thrombocytopenia (100,000 cells or less per cubic mm) and evidence of plasma leakage due to increased vascular permeability, manifested by one or more of the following:
- More than 20% rise in average hematocrit for age and sex
- More than 20% drop in hematocrit following volume replacement treatment compared baseline
- Signs of plasma leakage (pleural effusion, ascites, hypoproteinemia).

2.5.3 Dengue Shock Syndrome

It is defined as having all the above criteria, plus evidence of circulatory failure manifested by rapid and weak pulse, and narrow pulse pressure (less than 20 mmHg) or hypotension for age, cold clammy skin, and altered mental status.

2.6 Prevention and Control

In general, dengue control programmes in the South East Asia Region have not been very successful, primarily because they have relied almost exclusively on space spraying of insecticides for adult mosquito control. As a result, *Aedes aegypti* and other dengue vectors in several countries have developed resistance to insecticides (WHO, 1999). With no new mosquito control technology available, in recent years public health authorities have emphasized dengue prevention and mosquito control through community efforts to reduce larval breeding sources (CDC, 2001). As dengue vaccine are still under trial and there is no specific treatment for Dengue Fever, the only effective measure to prevent and control dengue is by preventing transmission of the disease by the Aedes mosquito (WHO, 2002). Prevention and control measures require active community participation and cooperation; therefore it is important to know the level of knowledge, attitude, and practices (K, A, P) of the community regarding Dengue Fever (Hairi et al, 2003).

2.7 Behavioral Theories

There are several theories based on various perspectives of behavioral change. When comparing, the Health Belief Model considers more comprehensively about factors that can influence preventive health behavior than any other behavioral models (Anspaugh et al, 2000).

The Health Belief Model is a psychological model that attempts to explain and predict health behaviors by focusing on the attitudes and beliefs of individuals. It was developed in the 1950s as part of an effort by social psychologists in the United States

Public Health Service to explain the lack of public participation in health screening and prevention programmes. Since then, the Health Belief Model has been adapted to explore a variety of long- and short-term health behaviors. In the Health Belief Model, two major factors influence the likelihood that a person will adopt a recommended preventive health action. First they must feel personally threatened by the disease i.e. they must feel personally susceptible to a disease with serious or severe consequences. Second they must believe that the benefits of taking the preventive action outweigh the perceived barriers to (and/or costs of) preventive action (Rosenstock, Strecher and Becker, 1994).

2.8 KAP studies on Dengue Fever

2.8.1 Relationship between Demographic Characteristics and Attitude

In a K, A, P study on dengue among selected rural communities in the Kuala Kangsar District, Malaysia during June, 2002, females (92.1%) appeared to have a better attitude towards the prevention of Aedes as compared to males (90.7%). Regarding the age group, those aged 50 and above (92.5%) showed a better attitude compared to those below 50 years (90%). For the level of education, all levels show good attitude (>90%). For the level of literacy, those who were illiterate showed a better attitude (100%) than those who were literate (90%). For the income class, the higher the income, the poorer the attitude. However, none of these observations were statistically significant (Hairi et al, 2003)

2.8.2 Relationship between Knowledge and Attitude

In a survey of knowledge and attitude in a population about dengue transmission in the region of Campinas Sao Paulo, Brazil in 1998, there was a major gap between knowledge and attitude in all regions (Donalisio, 2001). However, a K, A, P study on dengue among selected rural communities in the Kuala Kangsar District, Malaysia during June, 2002, found a significant association ($p = 0.047$) between knowledge of dengue and attitude towards Aedes control (Hairi et al, 2003).

2.8.3 Relationship between Knowledge and Practice

There have been contradictory results in previous studies with regards to the relationship between knowledge and practice of Dengue Fever. In some places, better knowledge of Dengue Fever was related to better practice in preventive and control measures. However, in other places knowledge of Dengue Fever was not accompanied by behavioral change.

According to a structured questionnaire survey regarding knowledge and use of preventive measures related to Dengue Fever in Northern Thailand in May 2001, persons with knowledge of dengue reported a significantly higher use of preventive measures than persons without knowledge of dengue (Van Benthem, 2002). A similar result was found in a survey of adult residents, mainly housewives about knowledge, attitude and practice of the prevention of DHF in the municipality of Mae Sot, Tak Province in 1990. In this survey, a total of 417 respondents from 417 households

selected by a systematic-cluster sampling method were interviewed. Those respondents who reported applying larval control methods for drinking-water containers, had significantly ($p<0.05$) higher knowledge about larval control measures than those who did not apply anti-larval measures (Swaddiwudhipong, 1992). Similarly, in Puerto Rico, health education programs for dengue prevention, were evaluated separately using knowledge and practices surveys administered to children and their parents, surveys of house lots for larval container habitats and focus group discussions. Exposure to the programs was associated with increased dengue-related knowledge, increased proportion of tires protected from rain, decreased proportion of water storage containers positive for mosquito larvae, and increased indoor use of aerosol insecticides (Winch, 2002). Another example of positive relationship between knowledge and practice of dengue prevention was found in a survey of housewives' behavior towards control of DHF in Surabaya in Indonesia, a significant correlation was found between the housewives' knowledge and their practice in controlling DHF. Better knowledge had better practices as high as 3.43 times (Andajani and Sustini, 1999).

Contrary to the above findings, a knowledge, attitude, and practice study, carried out by using structured interviews and mosquito larval survey of household compounds in Trinidad and Tobago found that respondents' knowledge about dengue prevention methods was not correlated with practice (Rosenbaum, 1995). Similarly, an evaluation of the results of an educational campaign and a survey of the relationship between population's knowledge and habits about dengue prevention and control in Sao Jose do Rio Preco, Sao Paulo State, Brazil, it was discovered that despite increased knowledge, the local population's habits did not change (Chiaravalloti, 1998).

2.8.4 Relationship between Attitude and Practice

The result of a study of factors affecting DHF prevention behavior in Nhatchanh commune, Benluc District, Longan Province in Vietnam, indicated a statistically significant relationship between prevention behavior and housewives' perception on severity and susceptibility to DHF as well as attitude on community-based prevention methods (Huu, 1998). Similarly, a descriptive study about preventive practice for dengue and its correlating factors in Phong Dien townlet residents, Thua Thien Hue Province, Vietnam, found that there was a significant association between the residents' attitude and preventive practice (Quan, 2001). However, a different result was found in a KAP study on dengue among selected rural communities in the Kuala Kangsar District, Malaysia during June, 2002, in which there was no association between attitude and preventive practices on Dengue Fever (Hairi et al, 2003).