A REVIEW OF DENGUE FEVER INCIDENCE IN KOTA BHARU, KELANTAN, MALAYSIA DURING THE YEARS 1998-2003

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Abstract. Dengue is the most common and widespread arthropod borne arboviral infection in the world today. It is estimated that there are at least 100 million cases of dengue fever (DF) annually and 500,000 cases of dengue hemorrhagic fever (DHF) which require hospitalization. In Malaysia, it has become a major public health problem. Malaysia recorded 19,544 dengue cases in 1997, the highest recorded since the disease was made notifiable in the country. Of 19,544 cases, 806 were DHF with 50 deaths. The objectives of this analysis were to describe the incidence of dengue fever and dengue hemorrhagic fever in Kota Bharu, Kelantan, Malaysia for the years 1998-2003 and to explore the characteristics of dengue fever and dengue hemorrhagic fever in Kota Bharu, Kelantan, Malaysia for years 1998-2003. A total of 4,716 dengue cases were notified involving 4,476 (94.9%) DF and 240 (5.1%) DHF cases, which increased though the years. The highest incidence was in January (701 or 14.9%), while the lowest was in May (188 or 4.0%). Forty percent of cases (n=1,890) were in the 15-29 year old group. The Majority were Malays (4,062 or 86.1%) and 2,602 or 55.2% were male. A total of 4,477 cases (95%) were local cases and 4,289 or 91% came from the urban area. For priority areas, 3,772 (80%) were from priority 1. More than half the cases had positive serology results. All symptoms occurred in more than 96% of cases and fever was the commonest (99.7%). The mean values for age, temperature, systolic and diastolic blood pressure (BP) were 27.8 ± 15.4 years, 37.9 ± 0.9ºC, 115 ± 15.2 mmHg and 73 ± 11.1 mmHg, respectively. The mean value for the time interval between the onset of symptoms and diagnosis, onset of symptoms and notification and time of diagnosis to notification were 5.1 ± 2.3, 5.9 ± 2.5 and 0.8 ± 1.1 days, respectively. There were associations between the types of dengue and classification, area and priority area. Among the symptoms, the association was only seen in joint pain. The mean significant differences between DF and DHF were found in age and systolic blood pressure. The incidence of dengue in Kota Bharu is comparable to that in Malaysia. The increase in the number of cases needs to be addressed promptly with effective surveillance, prevention and control programs.

INTRODUCTION

Dengue is the most common and widespread arthropod-borne arboviral infection in the world today. It is recognized in over 100 countries throughout the tropical and sub-tropical areas of the world putting over 2.5 billion people at risk of infection – equivalent to approximately 40% of the world's population. The endemic areas are Asia, the Pacific Islands, the Americas, Africa, and the Eastern Mediterranean. The highest burden of disease occurs in Southeast Asia and the Western Pacific, but over the last few years there has also been a rising trend in South America and the Caribbean (Anonymous, 2004). It is estimated that there are at least 100 million cases of DF annually and 500,000 cases of DHF which require hospitalization. Of the latter, 90% are children under the age of 15 years. DHF mortality rates average 5%, with approximately 25,000 deaths each year (WHO, 1999).

Continued trends of rapid population growth, increasing aggregation in urban centers, and ever larger volumes of international travel,

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combined with a lack of effective vector control, have encouraged rapid viral evolution and collectively augur an increasingly serious public health problem (Hay *et al*, 2000).

In Malaysia, DF was first reported in 1902 in Penang and has become a major public health problem, especially since the appearance of the first DHF outbreak in Penang in 1962. Rapid industrial and economic development over the past two decades has brought about massive infrastructure development, creating man-made environments for the breeding of *Aedes* mosquitoes (Academy of Medicine and Ministry of Health Malaysia, 2003). Notification of DF and DHF in Malaysia was implemented in 1971. Under the Prevention and Control of Infectious Diseases Act 1988, it is compulsory for all Medical Officers to notify all cases of DF, DHF and deaths due to dengue infection to the nearest district health office within 24 hours. Early notification is essential for control measures to be instituted immediately to prevent outbreaks (Academy of Medicine and Ministry of Health Malaysia, 2003). The incidence rate of clinically diagnosed DF and DHF reported is showing an upward trend from 8.5 cases/100,000 populations in 1988 to 123.4 cases/100,000 population in 1998. Malaysia recorded 19,544 dengue cases in 1997, 37.4% higher than the number reported in 1996 and the highest recorded since the disease was made notifiable in the country. Of 19,544 cases, 806 (4.1%) were DHF with 50 deaths. Out of 16,368 cases reported in the year 2001, 2,601 (22%) were among children 14 years and below. Similarly the case fatality rate (CFR) for DHF is high, ranging 5% to 6% per annum for both children and adults. As expected, there are more cases of DF than DHF, with a ratio of 16-25:1 over the last 5 years. In the year 2001, the DF:DHF ratio in children was 6.7:1 compared to 27.3:1 in adults (Academy of Medicine and Ministry of Health Malaysia, 2003). Most of the cases are reported among the urban population (70–80%) with the highest incidence in the working and school going age group, which correlates with the relatively high Aedes Index in construction sites, factories and schools (Academy of Medicine and Ministry of Health Malaysia, 2003). It occurs through out the year with the maximum number of cases reported during the months of July, August and September. Although all the states in the country were affected, most cases were reported in urban areas with a high population density (MOH, 2000). The objectives of this analysis were to describe the incidence of dengue fever and dengue hemorrhagic fever in Kota Bharu, Kelantan, Malaysia for the years 1998-2003 and to explore the characteristics of dengue fever and dengue hemorrhagic fever in Kota Bharu, Kelantan, Malaysia for the years 1998-2003.

MATERIALS AND METHODS

This is a secondary data review of all dengue cases notified to Kota Bharu district Health Office, Kelantan, Malaysia for the years 1998 to 2003. Kota Bharu is the state capital of Kelantan. All the cases were documented in Vekpro (Vector program) database. From there, it was exported to Microsoft Excel and later to the SPSS program. The analysis was done using SPSS version 11.0. Summary descriptive statistics (mean, standard deviation, frequency and percentage) of characteristics documented for dengue and dengue hemorrhagic fever were tabulated. The chi-square test (for categorical variables) and the independent *t*-test (for numerical variables) were used to look for differences in the characteristics of dengue and DHF.

RESULTS

Socio-demographic characteristics

A total of 4,716 cases of dengue fever and dengue hemorrhagic fever were notified to Kota Bharu district health office, Kelantan, Malaysia during a six year period, from 1998 to 2003, involving 4,476 (94.9%) dengue fever cases and 240 (5.1%) dengue hemorrhagic fever cases. Fig 1 shows the total number of cases of each year and the increasing trend in the number of cases. The highest number of cases was notified in January (701 or 14.9%) while the lowest was in May (188 or 4.0%). Differences in the number of cases both amongst years and amongst months were statistically significant. The highest percentage of cases fell in the age group 15 to 29 years

Table 1
Socio-demographic characteristics of dengue fever (DF) and dengue hemorrhagic fever (DHF).

Variables	DF		DHF		p-value
	Frequency	%	Frequency	%	
Race					
Malay	3,859	86.2	203	84.6	0.295
Chinese	536	12	36	15	
Indian	29	0.6	-	-	
Others	52	1.2	1	0.4	
Sex					
Male	2,483	55.5	119	49.6	0.074
Female	1,993	44.5	121	50.4	
Classification					
Local	4,256	95.1	221	92.1	0.039[a]
Import	220	4.9	19	7.9	
Area					
Urban	4,091	91.4	198	82.5	<0.001[a]
Rural	385	8.6	42	17.5	
Priority areas					
I	3,605	80.5	167	69.6	0.030[a]
II	563	12.6	40	16.7	
III	25	0.6	1	0.4	
IV	33	0.7	4	1.7	
unknown	250	5.6	28	11.7	
Dengue serology result					
Known	2,349	52.5	152	63.3	
Unknown	2,127	47.5	88	36.7	
Known result					
Positive	1,356	57.7	81	53.3	0.284
Negative	993	42.3	71	46.7	

[a]Chi-square test is significant at $\alpha = 0.05$ level

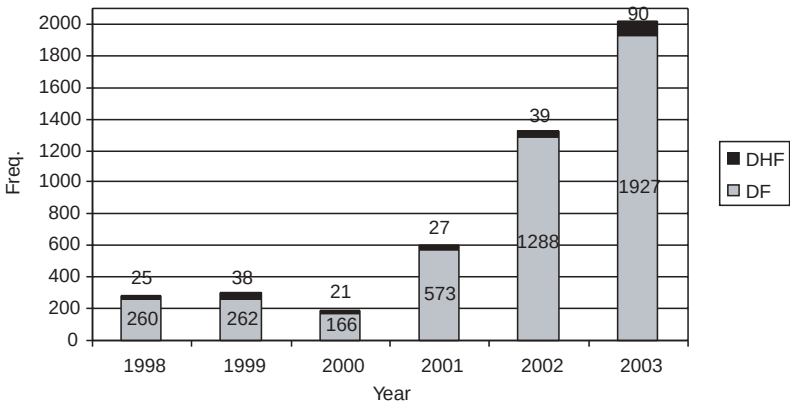

Fig 1–Number of dengue fever (DF) and dengue hemorrhagic fever (DHF) cases by year.

old which contributed to 40.1% of cases (n=1,890).

The majority of cases were Malays (4,062 or 86.1%) and more than half (2,602 or 55.2%) were male. Regarding classification of cases, almost 95% of all cases (n=4,477) were local cases. It also showed that 91% of cases (n=4,289) came from an urban area. For priority areas, 3,772 or 80% of all cases were from priority area 1. However, nearly 6% of the data was not available. Nearly

Table 2
Symptoms of dengue fever (DF) and dengue hemorrhagic fever (DHF).

Symptoms	DF		DHF		p-value
	Frequency	%	Frequency	%	
Fever					
No	12	0.3	2	0.8	0.157
Yes	4,464	99.7	238	99.2	
Muscle pain					
No	141	3.2	12	5	0.115
Yes	4,335	96.8	228	95	
Headache					
No	61	1.4	5	2.1	0.387
Yes	4,415	98.6	235	97.9	
Joint pain					
No	78	1.7	9	3.8	0.042[a]
Yes	4,398	98.3	231	96.2	
Petechia					
No	127	2.8	12	5	0.054
Yes	4,349	97.2	228	95	
Vomiting					
No	92	2.1	7	2.9	0.365
Yes	4,384	97.9	233	97.1	
Rashes					
No	88	2	6	2.5	0.479
Yes	4,388	98	234	97.5	

[a]Chi-square test is significant at $\alpha = 0.05$ level

50% of the results for dengue serology was not available. Among those that were available (2,501 cases), 57.5% of the cases was positive.

For classification of priority areas, we referred to the classification used by the Section of Vector Borne Disease Control, Ministry of Health, Malaysia, in which Priority I refers to localities where an outbreak or a case of dengue has occurred in the past, while Priority II refers to localities with an urban environment and with a high Aedes index (AI $\geq$ 5%) and/or Breteau Index (BI $\geq$ 20). Priority III refers to areas with an urban environment but with a low Aedes index (AI $\leq$ 5%, BI $\leq$ 20). Priority 1V refers to rural areas where there are no cases of dengue and low Aedes indices.

Clinical symptoms and parameters measured

Among all symptoms, the commonest symptom experienced by the cases was fever (99.7%). As a whole, all symptoms occur in more than 96% of cases. The mean (standard deviation) for age, temperature, systolic blood pressure and diastolic blood pressure were 27.8 ± 15.4 years, 37.9 ± 0.9ºC, 115 ± 15.2 mmHg and 73 ± 11.1 mmHg, respectively. The mean value (standard deviation) for the time interval between the onset of symptoms and diagnosis, onset of symptoms and notification done and time of diagnosis to notification were 5.1 ± 2.3, 5.9 ± 2.5 and 0.8 ± 1.1 days, respectively.

Difference between dengue fever and dengue hemorrhagic fever

The socio-demographic characteristic differences between DF and DHF are shown in Table 1. The association between variables and the incidence of DF and DHF were assessed. The variables found to be statistically significant were classification, area and priority areas.

Table 2 shows the differences in occurrence of symptoms between DF and DHF. These were

Table 3
Differences in mean age, temperature, blood pressure (BP) and time intervals measured in dengue fever (DF) and dengue hemorrhagic fever (DHF).

Variables	DF		DHF		p-value
	Frequency	%	Frequency	%	
Age (year)	28	15.4	23.8	15	0.000[a]
Temperature (°C)	37.9	0.9	37.8	0.9	0.567
Systolic BP (mmHg)	115.3	15.2	113.1	14.7	0.032[a]
Diastolic BP (mmHg)	73.2	11.1	72.7	11.5	0.526
Time interval (day)					
Onset-diagnosed	5.1	2.3	5.1	2.2	0.996
Onset-notified	5.9	2.5	5.9	2.3	0.838
Diagnosed-notified	0.8	1.1	0.8	1.1	0.606

[a]Independent *t*-test showed the mean difference is significant at $\alpha = 0.05$ level

different only in joint pain.

Table 3 displays the result of the independent *t*-test done to look at the mean differences in age, temperature, BP and various time intervals measured for DF and DHF. The mean ages in DF and DHF were 28.0 years old and 23.8 years old, respectively. The difference (4.2 years) was found to be statistically significant. The other variable, which was found to be significant, was the systolic BP. The mean for DF was 115.3 mmHg while the mean for DHF was 113.1. The others were not significantly different.

DISCUSSION

Dengue fever has been one of the main communicable diseases in the district of Kota Bharu since 1996. There was a sharp increased in incidence of dengue in the year 2002 compared to the previous year. The Kota Bharu area contributed almost 70% of the dengue fever cases in Kelantan (Kota Bharu Health Office, 2003). The overall incidence of dengue cases for six years notified to the Kota Bharu district Health Office showed that the ratio between DF:DHF was 18.65:1. This number was lower than that reported by the Ministry of Health (MOH), Malaysia. The ratios of dengue fever to dengue hemorrhagic fever for the years 1996 and 1997 were 25.7:1 and 23.2:1, respectively (Anonymous, 1998). There was an increased number of cases of DF compared to DHF. The number of cases was significantly increasing by years in Kota Bharu except for a slight reduction in 2000, in which there was a 37.7% reduction in all cases as compared to 1999. Result from the MOH, Malaysia also showed that from 1988 the number of cases reported showed an upward trend until 1998. One of the reasons for this increase was due to the period of rapid urbanization and industrialization after 1988, which gave rise to increased breeding areas for the Aedes mosquitoes. In 1999, there was a drop in the incidence rate to 43.8 per 100,000 population from 123.4 per 100,000 population in 1998. One of the reasons for the drop in incidence rate was due to the success of the "National Cleanliness and Anti Mosquito Campaign" launched in April 1999 (MOH, 2000). A similar study showed that a total of 7,118 dengue cases along with 37 dengue related deaths were reported throughout 2000. This again showed a decrease of 3,028 cases or 29.8% compared to the number of cases reported in 1999. The reduction was a result of the anti mosquito and hygiene campaigns that are still on going since they were launched.

The months with the three highest numbers of cases were January, followed by February and December. These months were during the rainy season in Kelantan. There was probably an increase in breeding sites during those months due

to the accumulation of water in containers and construction sites. The increase in dengue cases was also due to the public's failure to ensure cleanliness. Indiscriminate throwing of rubbish and dirty home surroundings contributed to the breeding of Aedes mosquitoes, especially during the rainy season. A report from the MOH (2000) said that the high incidence of dengue was probably the result of an increase in breeding places at construction sites. Epidemics of dengue have shown an association with construction activities and construction sites. There was a decrease in the number of cases reported during the months of April to June, which were during the dry season in Kelantan. However when we compared this with the report from the MOH (2000), it showed that the number of cases reported was low in the months of January to April. In the report, the following months showed a gradual increase in the number of cases, with a peak in the months of July and August. This trend in seasonality is related to water collection. The start of light rainfall after the dry season in January to April, and rainfall before the monsoon season, increased the breeding places of A*edes* (MOH, 2000). This difference may be due to the different monsoon seasons between the West coast and East coast of Peninsular Malaysia.

The majority of cases in this analysis were Malays. This is because the majority of people in Kota Bharu and Kelantan generally are Malays. This differed from the MOH report (1996). Among the ethnic groups, Chinese constituted the majority of cases of dengue at 43.0%, followed by the Malays (39.1%), Indians (6.3%), Bumiputera Sarawak, Bumiputera Sabah and others. However there was an increase in the number of cases among the Malays and Indians. This was the result of the expansion of urban areas and migration of Malays from the villages to the urban and sub urban areas. The male: female rates in this study was 1.2:1 (55.2% versus 44.8%). Our findings are similar to a report from the MOH (1996), in which males showed a greater predisposition to dengue compared to females with a ratios ranging from 1.1:1 to 1.3:1 for the year 1990-1995.

This study showed that almost 95% of all cases were local cases. This possibly showed that we still have a lot of breeding places in the community and the populations are at high risk for dengue infection in their surroundings. Dengue is considered an urban public health problem. The results obtained from this analysis supported this, as 90.9% of cases came from the urban area. A MOH report (1996), covering a period of 6 years (1990-1995), revealed the percentage of cases reported from urban areas ranged from 73.5% to 87.6%. The same trend was shown for the years 1975-1982, where the urban areas contributed 82.85% of the notified cases. For priority areas, 80% of the cases were from priority 1, meaning that the majority of the cases occurred in localities where an outbreak or a case of dengue had occurred in the past. This result was expected, since priority area 1 is an area that has a high concentration of cases and/or a high vector density. However, it reminded us that special attention should be more focused on dengue surveillance and control in that area so that we can further reduce the spread of dengue and reduce its incidence. This analysis also showed that half of the dengue serology data were not available. This may be due to several reasons. First, it may be the investigation was not done and the diagnosis of dengue was based on clinical judgement. Other than that, the result may not be available due to a lack of tracing done by the officer in the health office. From this analysis, all symptoms occurred in more than 96% of cases. This was very high compared with other studies. A study done in Palau, in the Western Pacific (Ashford ***et al***, 2003) reported the symptoms ranged from 7-100%. The commonest symptom was also fever, which was reported by 100% of cases, followed by headache in 91% of cases. The least common reported symptom was bleeding (7%). The mean age of cases was 27.8 years old. The age group incidences in this study did not differ from the Ministry of Health (MOH) report. The MOH Annual Report 2000 also showed that, the 15-29 year old age group had the highest incidence rate for dengue, which was similar to our study. This showed a different trend compared to the epidemics of the 70s and 80s, in which the majority of cases were children below 15 years old.

The mean temperature was 37.9ºC, which was mildly elevated. The means for the systolic and diastolic blood pressures were 115 mmHg and 73 mmHg, respectively. This shows that the overall means for the blood pressure were within the normal range. It is possible that very few patients had an abnormal BP, or that the effect was diluted because most cases had a BP within normal limits.

Five days was the average length of illness reported. The mean number of days from the onset of symptoms to the diagnosis of dengue were 5.1 days. This showed a delay in the diagnosis of cases. By 5-6 days the fever had subsided in DF and DHF cases, and the hemorrhagic manifestations have presented themselves already. A report from the WHO in 1999 stated that DHF/DSS usually develops between the 3rd and 7th day of illness. Furthermore the mean number of days from the onset of symptoms to the notification of cases to the district health office was nearly six days. This delay could allow the spread of disease in the community. According to the Prevention and Control of Infectious Disease Act 1988, dengue fever and dengue hemorrhagic fever are diseases that need to be notified within 24 hours to the nearest district health office. This study showed that the time interval from diagnosis to notification was less than one day. This complied with the act. It showed that the medical officer or personnel in charge were aware of the importance of urgent notification of disease after the diagnosis of dengue is done. It would be beneficial if there was an improvement in the time of diagnosis of dengue cases. Hopefully this would help the district health office staff to carry out an early intervention and control program.

Difference between DF and DHF

Regarding the difference between dengue fever and dengue hemorrhagic fever, the incidence of dengue fever and dengue hemorrhagic fever was significantly related to classification, area and priority area of the cases. These were more dengue fever local cases than dengue hemorrhagic fever cases. These were more dengue fever cases from urban areas than dengue hemorrhagic fever cases. These were also more DF than DHF cases in priority area I. The only statistically significant difference in symptoms between DF and DHF was joint pain. For mean age, temperature and blood pressure (BP), the significant mean differences were found only in age and systolic BP. For DF, our results showed that the mean age was 28.0 years old which was significantly older than those with DHF, which was 23.8 years old. A report from Singapore said that in Singapore, both DF and DHF now occur most frequently in those aged 16-25 years (Chan *et al*, 1995). For SBP, the mean in DF cases was 115.3 mmHg, which was statistically higher than 113.3 mmHg with DHF. However, both means were within the normal range of SBP and were not consider clinically significant. There were no differences in the mean time periods measured for both DF and DHF. In doing this analysis we had several limitations. First of all, our data were obtained from notifications made by medical officers over a period of 6 years. Misdiagnosis and misclassification of DHF and DF cannot be excluded. Furthermore, we relied on data that was keyed in by staff from the health office. We did not check for the problem of wrong data entry and missing values.

In conclusion, the analysis showed that the incidence of dengue in Kota Bharu is comparable to that in Malaysia, even though we can see differences in some aspects. The increasing trend in the number of cases reported needs to be addressed promptly. Effective prevention and control programs will depend on improved surveillance designed to provide an early warning of dengue epidemics. Virologic surveillance should be considered the most important element in any such early warning system. Dengue virus transmission should be monitored to determine which serotypes are present, their distribution, and the type of illnesses associated with each. In the control of man-made and natural breeding sites of dengue vectors, public health workers should simultaneously work to modify human behavior through health education and public health communication, in order to reduce the number of breeding sites produced by the community. The program must emphasize that mosquito control is a responsibility of everyone in the community, not just those in

government. Entire families must be educated and encouraged to become involved in vector elimination.

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