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Prevalence of Dengue Fever in Jizan Area, Saudi Arabia

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Dengue is a human arbovirus disease transmitted by the female mosquito of the genus *Aedes*. It from infection by one of four serotypes. Named dengue 1, 2, 3, and 4. It is the most important disease caused by an arbovirus worldwide, especially in the tropical and sub-tropical regions. A total of 553 patients were reported as suspected cases of dengue fever with blood samples from April 2010 to ending March 2011, out of which 264 were confirmed to be positive serologically for dengue infection, amounting to 47.74% positivity rate. The highest number of cases were recorded in the month of April 73(27.69%), but lowest number was recorded in the month of August 2011 (2cases, 0.75%). Age wise distribution of cases revealed a range between 3-56 years, Saudi 215(81.44%), non-Saudi 49(18.56%).

Key words: Dengue fever, Jizan area, Saudi Arabia.

Dengue is a human arbovirus disease transmitted by the female mosquito of the genus *Aedes*, mainly *Aedes aegypti* and *Ae. albopictus*[1]. Dengue results from infection by one of four dengue virus serotypes, named dengue-1, 2, 3, and 4; it is the most important disease caused by an arbovirus worldwide, particularly in the tropical and sub-tropical regions. Two-fifths of the world population (about 2.5 billion people) is at risk of dengue infection. The spread of the disease has increased significantly in recent decades. Between 50 and 100 million people are infected each year worldwide and more than 500,000 are hospitalized [2]. The average annual incidence was multiplied by thirty in the last fifty years. Incidence of dengue haemorrhagic fever (DHF) is increasing in many tropical regions inducing 20,000 deaths per year, mostly among children under 15 years [3].

Its clinical manifestations range from asymptomatic infections to a severe disease characterized by hemorrhage and shock, known as dengue hemorrhagic fever/dengue shock syndrome (DHF/DSS). DHF is characterized by plasma leakage and a hemorrhagic diathesis that is apparent by the time of effervescence, typically after five days of fever. In severe DHF, mortality results from hypotension and shock, at times accompanied by severe coagulation abnormalities and bleeding [4].

Epidemiology of dengue fever (DF) is changing dramatically. The worldwide incidence is rising and clinical symptoms are worsening. Reports describing forms associated with hemorrhages or shock syndrome involving both children and adults are increasingly frequent in regions beyond Southeast Asia where the first cases were observed. Many mechanisms could be implicated in these changes, including

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modifications of the virus, host, vector, or socio-economic factors. The new facilities in the laboratory diagnostic (ELISA; molecular biology), the commercialization of these assays allow not only assessment of morbidity and mortality in endemic areas and early detection of epidemic outbreaks but also evaluation of socio-economic impact and effectiveness of control measures[5].

Thus, our research for this paper was conducted to estimate Dengue fever prevalence in Jizan area, with the aim of contributing to dengue surveillance improvement quality.

METHODS

Description of the study area

Jazan Region is located in the southwestern part of the Kingdom of Saudi Arabia between longitudes (42-43), the east and latitudes (16-17) in the north. It is bounded on the north and east of the Asir region to the west along the Red Sea coastline about 330 km, and the south and south-east Republic of Yemen.

Plains of the region such as the shores of the Red Sea is heavy rain and humid summer climate is hot while the section of high mountain climate is mild in summer and winter, but closer to the cold during the winter.

Different degrees of humidity differ according to different sections of the region. The average humidity in summer, beaches and plains, ranges from 50 to 85 and in the winter from 30 to 50. In the mountains, humidity ranges from almost 20 to approximately 25. The area receives rainfall as seen in the table.

Table 1. The amount of rainfall (both in millimetres and inches) and number of rainy days in Jizan throughout the year

Month	January	February	March	April	May	June	July	August	September	October	November	December
Total rainfall in MM	10.8	4.5	12.1	12.7	9.9	1.1	9.7	16.2	12	20.8	13.6	17.5
Total rainfall in Inches	0.4	0.2	0.5	0.5	0.4	0.0	0.4	0.6	0.5	0.8	0.5	0.7
Total number of rainy days	2.2	1.6	1.3	2	0.9	0.7	1.3	2.9	1.6	1.6	1.4	2.2
Chances of rain %	7.1	5.7	4.2	6.7	2.9	2.3	4.2	9.4	5.3	5.2	4.7	7.1

Study population

A cross-sectional (prevalence) study was conducted from April 2010 to March 2011 in Virology Laboratory of King Fahd Central Hospital in Jazan Area (Kingdom Of Saudi Arabia) .A total of 553 hospitalized cases suspected of having Dengue fever, with non –specific fever, coupled with two or more of the following: headache, retro-orbital pain, myalgia, arthralgia, rash, hemorrhagic manifestations, and leucopenia with no localized signs or symptoms were examined clinically and blood samples were collected when suspected cases were first seen.

Host immune status

The interpretation of primary and

secondary serological responses was based on the magnitude of IgG ELISA units in serum samples using a reference IgM and IgG antibody capture ELISA as described previously [6].

Case definition

DF and DHF were diagnosed according to 1997 World Health Organization (WHO) classification criteria and was applied to each case after review of study notes [7]. The 1997 definitions were used for this study because at the time of clinical assessment the 2009 WHO Guidelines and revised classification scheme was not available. DF was defined as a laboratory confirmed dengue case with no evidence of capillary permeability as defined for a DHF case. DHF was defined as laboratory confirmed dengue case with thrombocytopenia (<100,000 platelets/mm^3), any hemorrhagic manifestation, and evidence of plasma leakage (as denoted by a >20% increase in the Hct from the baseline value or by the presence of pleural or abdominal effusions).

Serum specimens

Blood samples were collected from 553 patients for diagnosis of Dengue fever. Most of the samples were collected during 5 to 10 days of illness. Serum samples were separated and tested in duplicate by ELISA for detection of Dengue virus nonstructural protein NS1 antigen (NS1) by pan-E dengue early, ELISA kit, dengue IgM by Panbio Dengue IgM Capture ELISA kit and Dengue IgG by Panbio Dengue IgG Capture ELISA kit (Panbio, Queensland, Australia). Detection was performed according to the manufacturer's recommendations.

RESULTS

A total of 553 patients were reported as suspected cases of dengue fever with blood samples from April 2010 to ending March 2011, out of which 264 were confirmed to be positive

Table 2. Showing distribution of positive results as per serological marker among 264 positive results

Markers	No. of samples positive	%
NS1	67	25.38
IgM	71	26.98
NS1 +IgM	95	35.98
IgM+IgG	31	11.74

Table 3. Depicts month wise distribution of positive cases among 264 positive results

Month	January	February	March	April	May	June	July	August	September	October	November	December	Total year
No of Positive	73	48	14	4	2	3	7	21	31	10	21	30	264
% of Species	27.69	18.18	5.3	1.5	0.57	1.14	2.65	7.95	11.74	3.79	7.95	11.36	100

Table 4. Showing distribution of cases as per age groups with percentage

Age	Age group in years					
	0-1	1-4	5-14	15-44	45&above	Total
No. of case	0	6	89	139	30	264
%	0	2.27	33.71	52.66	11.36	100
Group total		95	(35.98%)	169	(64.02%)	100%

serologically for dengue infection amounting to 47.74% positivity rate. All these positive results were tabulated for analysis purpose. Of the 264 dengue positive sera 67(25.38%) were positive by NS1 antigen, 71(26.98%) by dengue IgM, 95(33.95%) by both NS1+IgM and 31(11.74%) by both IgM and IgG respectively (Table 2). The highest number of cases were recorded in the month of April 73(27.69%) followed by May 2010(48cases, 18.18%), but lowest number was recorded in the month of August 2011(2cases, 0.75%) Table 3. Figure 1. Age wise distribution of cases revealed a range between 3-56 years with minimum number of cases 6(2.27%) in the category of 1-4 years and maximum in the category of 15-44 years (139 cases, 52.66%). (Table 4). Of the total positive cases males

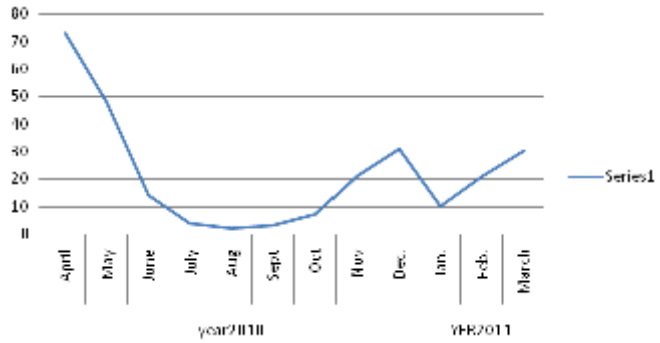

Fig. 1. Distribution of positive Dengue cases from April 2010 to April 2011

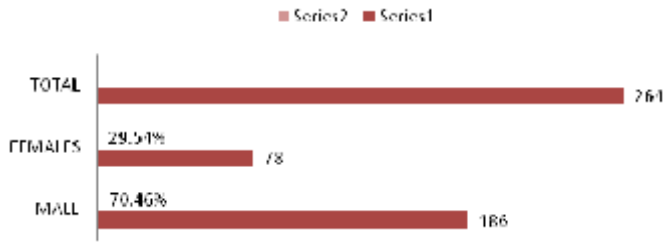

Fig. 2.

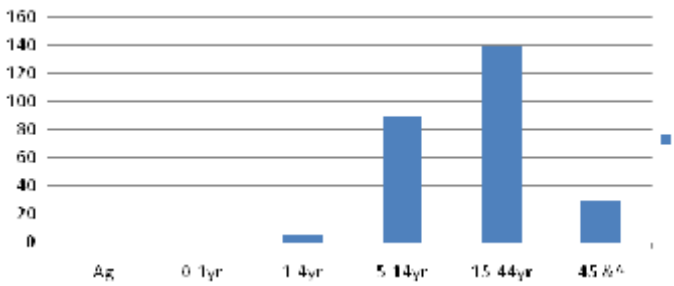

Fig. 3. Distribution of cases as per age groups with percentage

constituted 186(70.45 %.) and females 78(29.55%) Fig: 3; out of which Saudi comprised of 215(81.44%) and non-Saudi 49(18.56%), non-Saudis being 45 Yemeni nationals and 4 Indians Table 5.

DISCUSSION

In Saudi Arabia, Dengue virus was first isolated in Jeddah from a fatal case of Dengue hemorrhagic fever (DHF). Whereas, the first outbreak was recorded in Jeddah, Saudi Arabia in 1994. During the 21stcentury, dengue has been absent or rare in Saudi Arabia [8]. As Dengue virus is transmitted by *Aedes aegypti* and *Ae. albopictus* which are prevalent in tropical and subtropical regions throughout the world. There are many factors help the spread of the disease in this area. Many employees come from India, Indonesia, Pakistan, Yemen and other travelers from Africa. Some of these persons may be in the incubation period of dengue infection and may be viremic, infecting mosquitoes and subsequently infecting other persons. Also the climate of Jizan enhances the breeding of mosquitoes, especially during rain fall and high humidity. Another factor is the storage of water in containers that served as breeding sites of mosquitoes.

This study represents the data base for prevalence of Dengue Fever in Jizan area. The study covers all hospitalized cases during one year started from April 2010 ending at March 2011. During April and May 2010 there was an outbreak in Jizan where the number of positive hospitalized cases reached 208. This outbreak is coincide with the rainfall and high humidity, which help breeding of mosquitoes. There was an outbreak in Jeddah at the same time. Some cases were reported in Yemen which is the south border of Jizan. In India during 2009, DF cases reached 11,476. These trends demonstrate that DV has penetrated deep into India, with DENV2 and DENV3 predominating among different DENV serotypes [9]. In Sri Lanka from 2006 to 2008 the total number of reported cases reached more than 24,000 with a peak in 2006, nearing 12,000. The year 2008 saw half the number of cases as seen in 2006 [10]. The morbidity rate was also significantly less in 2008 with 5.644 cases; however, morbidity was consistent in 2006 to 2007. During the last year reported cases reached a staggering 35,000 with more than 340 dengue associated deaths [11]. In Bangladesh from 2000 to 2002 saw a sudden surge in DF cases with more than 5,000 cases [12]. In 2007 there were 466 cases. The case fatality rate was the highest in 2006, but there were no reported deaths in 2007-8[13]. In Pakistan here is a lack of valid data on reported cases of DF/DHF until 1994. An outbreak in 2006 was dominated by DENV2 and DENV3 [14].

The 2004 WHO Global Epidemiology of Infectious Diseases Study estimated that 2.4% of global DHF cases occurred in Africa and that 20% of the population in Africa was at risk for Dengue[23].

Diagnosis of dengue virus infection based on clinical syndromes is not reliable and should be confirmed by laboratory studies [15]. With the escalating incidence of dengue infections and the absence of vaccines for the prevention of this disease, early diagnostic confirmation of dengue virus infections in patients is needed, as it allows for timely clinical intervention, etiologic investigations, and disease control. Hence, diagnosis of dengue disease during the acute phase should be a priority for patients and for public health reasons [15]. In this study, positive cases were diagnosed by detection of NS1 antigen, Dengue IgM and Dengue IgG by ELISA. 25.48% were NS1 positive and 35.98% were positive for both NS1 and Dengue IgM. This indicates that those patients were in the early phase of acute infection (within 4-7 days) ,as the virus is found in serum, plasma, and circulating blood cells, as well as other tissues, for 4 to 7 days, after the onset of illness [15]. The use of NS1 detection in the diagnosis of dengue virus infections has been evaluated in many laboratories [16-19]. The PanBio dengue NS1 antigen capture ELISA was shown to be able to detect NS1 antigen in acute-phase sera from both primary and secondary infections[20-22]. 26.9% and 35.98% were IgM positive, since anti-dengue IgM antibodies appear within five days of the first clinical symptoms. The IgM production varies considerably among the patients. Some patients will have IgM detectable by the 2nd to the 4th day after the beginning of the symptoms, while others do not develop detectable IgM until the 8th day after disease onset [24]. AS IgM titer was high among those patients therefore having primary infection. While 11.74% were positive for both IgM&IgG. 3.2% of them were having high IgG titer and low IgM titer which indicate secondary

infection, which also reflects the presence of more than one serotype. The others were in the convalescent phase.

The IgM production is much lower and transitory in secondary and tertiary infections [17]. 1% of patients have secondary infection with no IgM antibodies detected [25].

Our data showed sex differences with a male predominance. The underlying causes may be because males are exposed to mosquitoes than females. This study determine the highest incidence of dengue among adult (15-44 year old). Other studies determined disease incidence in children [26-31].

Our study has a number of limitations that should be considered. Firstly, it was a cross sectional study relying on past exposure, rather than a prospective incidence study. Secondly, specific documentation of DV serotypes that firmly establish the circulation of different viral variants was not performed due to logistic and financial constraints. Also the milder cases treated on an outpatient basis were not captured.

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