

# Sero-prevalence of Dengue virus infection and associated factors among patients with febrile illness attending at Edna Adan University Hospital, Hargeisa, Somaliland, 2022: A cross-sectional study

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## ABSTRACT

**Background:** DENV infection is increasingly recognized as one of the world's emerging infectious diseases. The global incidence of dengue has grown dramatically with about half of the world's population now at risk. Although an estimated 100-400 million infections occur each year, over 80% are generally mild and asymptomatic. While estimates of dengue deaths are less often reported, the most commonly cited figures are around 20 thousand annual dengue deaths.

**Methods:** Hospital-based cross-sectional was conducted on a total of 54 patients with febrile illness from October to November 2022. A systematic sampling method was employed and pretested structured questionnaires were used to collect socio-demographic characteristics and other associated factors. Therefore, 5ml of venous blood was collected aseptically from each of the patients, and DENV was screened using SD-Bioline rapid test. Chi-square was conducted to determine the associated factors of DENV.

**Results:** The overall incidence rate of dengue virus infection among the patients with febrile illness in the study area was 20 (37%), Gender of the patient ( $p < 0.007$ ), presence of fever ( $p < 0.001$ ) and retro-orbital pain were significantly associated with the dengue seropositivity.

**Conclusion:** in conclusion, a high incidence rate of dengue virus infection (37%) was reported in the study area. Future large-scale investigation and molecular detection are warranted to discover different virus serotypes. This study also provides the first evidence of dengue virus infection circulation in Somaliland.

**Keywords:** Dengue virus, Edna Adan University Hospital, febrile illness, Somaliland

## INTRODUCTION

Dengue is a mosquito-borne viral disease that has rapidly spread to all regions of WHO in recent years. Dengue virus is transmitted by female mosquitoes mainly of the species *Aedes Aegyptus* and, to a lesser extent, *Ae. Albopictus* [1]. Infection is caused by any one of four closely related dengue viruses (called serotypes) [2]. The disease is commonly characterized by a rapid onset of fever, headache, rash, and severe joint and muscle pain [3]. Repeated infections with different serotypes can cause a life-threatening condition called severe dengue [4].

DENV infection is increasingly recognized as one of the world's

emerging infectious diseases [5]. The global incidence of dengue has grown dramatically with about half of the world's population now at risk. Although an estimated 100-400 million infections occur each year, over 80% are generally mild and asymptomatic [1]. While estimates of dengue deaths are less often reported, the most commonly cited figures are around 20 thousand annual dengue deaths [6].

In Africa, Dengue fever has been reported in 34 countries, mostly in Eastern Africa [7]. Even though outbreaks of Dengue fever have been reported, there is limited data on the incidence and prevalence of the disease. The first report of Dengue in Africa was in the late 19th and early 20th centuries from Burkina Faso,

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Zanzibar, Senegal, Egypt, and South Africa [8]. In the countries bordering Somaliland such as Ethiopia and Djibouti, dengue has also been reported [9-10].

Known risk factors for dengue virus infection include those that facilitate mosquito breeding sites, such as extended rainfall and high humidity, and high temperature [11]. Having indoor and outdoor water containers—especially uncovered containers such as buckets, drums, tires, pots, and jerry cans—with stagnant water provides breeding sites to for *Ae. aegypti* in urban areas and facilitates transmission [12]. The absence of door and window screens and failure to use repellents has also been shown to facilitate infection [13]. This is crucial since Somaliland's weather causes a frequent practice of napping throughout the day.

In This Year, Somaliland Ministry of Health confirmed the first outbreak ever of Dengue Fever; the outbreak occurred in the capital city, Hargeisa. The objective of the present study is to estimate the prevalence of dengue fever by the detection of DENV-specific antibodies (IgM/IgG).

## METHODS AND MATERIALS

### Study Area, Design and Period

We conducted A hospital-based descriptive cross-sectional study from October to 2022 November 2022 in Edna Adan Hospital (EAH), Hargeisa, Somaliland. The hospital is located in Maroodi Jeex Region, the capital city of Somaliland known as Hargeisa. EAH is found in the southern part of Hargeisa. Based on the census conducted in 2006, Hargeisa has a total population of 1.5 million (Central Statistics Department of Somaliland) The city has one referral Hospital, two general Hospitals, seven healthcare centers, and five private Hospitals, and other several private clinics.

The EAH is one of the largest maternity private hospitals in the city, which was providing services for the community especially, maternal and child health services, for patients from all parts of Somaliland and other neighborhood regions such as Puntland, and southern Somalia. Edna Hospital was founded by a famous lady in the context of Somalia and the world as well.

### Study Population

The source population comprised all the patients attending at Edna Adan Hospital, particularly the medical ward. While the study population was patients having febrile illness in the Edna Adan Hospital during the study period who fulfilled the inclusion criteria.

### Inclusion and exclusion criteria

Patients with fever, nasal bleeding, or symptoms of the diseases (Dengue fever) were included in the study. Those who did not show dengue symptoms or had other diseases were excluded from the study.

### Sample size determination and sampling technique

We included all patients who attended the EAU hospital during the data collection period.

### Study Variables

#### Dependent variables

Status of dengue fever

#### Independent variables

Age, Residence, chronic diseases, and presence or absence of fever, dengue rapid antibody test

#### Data collection procedures

We used a checklist to collect the socio-demographic characteristics of the patients and related clinical data by the investigators.

#### Data collection procedure

Data were collected using a validated and pre-tested checklist by the hospital staff (Nurses) to collect socio-demographic data and other clinical variables to dengue virus infection.

Five milliliters (5 MLS) of whole blood was also collected from each patient by venous puncture, and serum was separated for further analysis.

#### Blood Sample Collection and Screening of HBsAg

Five milliliters (5ml) of venous blood was drawn under aseptic conditions in sterile disposable syringes by experienced laboratory personnel and then nonadditive sterile test tubes were dispensed. These tubes were labeled and processed at the time of sample collection. The blood samples taken from the participants were centrifuged at 3000 revolutions per minute (RPM) for at least 10 minutes at room temperature. All serum samples were tested for DEN antibodies (IgM /IgG) using (SD-BIOLINE Standard Diagnostics, Inc., rest-of-world) rapid test method according to the manufacturer's instructions. SD-BIOLINE rapid test is a qualitative, solid phase, two-site sandwich immunoassay for the detection of DEN antibodies in serum DEN infection status – was defined by a positive or negative result for DEN antibodies using the DEN test card.

#### Data Processing and Analysis

The collected data were checked, coded, and entered into SPSS version 23 for analysis. Descriptive statistics were done and result was presented using text and frequency tables.

#### Ethical considerations

Ethical approval of the study was obtained from Edna Adan University. Written consent was also obtained taken after informing the purpose and importance of the study to each participant. All risks and benefits were explained to the patients. Information provided by the participants was strictly kept confidential.

## RESULTS

### Socio-demographic and clinical characteristics of the study participants

A total of 54 patients were recruited in the study with a response rate of (100%), the majority (29.6%) of the patients were older than 50 years followed by the age group of 41-50 years (27.8%).

Females accounted for 53.7%, 68.5% were urban dwellers, 38.9% had chronic diseases, 68.5% had fever, 41.5% had retro-orbital pain 33.3% had myalgia, and 37% were positive for dengue rapid antibody test (IgM) Table 1.

### The incidence rate of Dengue fever in the study participants

In this study, the overall incidence rate of DEN was reported 20 (37%). A higher incidence rate of the fever (5.9%) has been

**Table 1:** Sociodemographic characteristics of the patients admitted to Edna Adan University Hospital, Hargeisa, Somaliland (n= 54).

Variables	Categories	Frequency	Percentage
<b>Gender</b>	Male	25	46.30%
	Female	29	53.70%
	<b>Total</b>	54	100%
<b>Age</b>	Oct-20	6	11.10%
	21-30	11	20.40%
	31-40	6	11.10%
	41-50	15	27.80%
	>51	16	29.60%
	<b>Total</b>	54	100%
<b>Resident</b>	Urban	37	68.50%
	Rural	17	31.50%
	<b>Total</b>	54	100%
<b>Chronic diseases</b>	Yes	21	38.90%
	No	33	61.10%
	<b>Total</b>	54	100%
<b>Fever</b>	Yes	37	68.50%
	No	17	31.50%
	<b>Total</b>	54	100%
<b>Dengue test</b>	Negative	34	63%
	Positive	20	37%
	<b>Total</b>	54	100%
<b>Retro-orbital Pain</b>	Yes	17	31.50%
	No	37	68.50%
	<b>Total</b>	54	100%
<b>Myalgia</b>	Yes	18	33.30%
	No	36	66.70%
	<b>Total</b>	54	100%

observed in patients older than 50 years followed by 5.6% of the patients aged between 41-50 years.

### Dengue fever among participants with febrile illness

As the below [Table 2] indicates 20(37%) of the patients with febrile illness tested positive for dengue fever. Ten (50%) of the study participants tested positive for dengue fever IgG, 35% tested positive for IgM while about 15% of the study subjects were positive for both IgG and IgM.

### Factors associated with Dengue fever

Factors such as Gender, presence of fever, and Retro-orbital pain are associated with the dengue fever of patients at Edna Adan University Hospital ( $P < 0.05$ ) [Table 3].

## DISCUSSION

Dengue fever infection has always been considered an emerging public health problem in several African countries and tropical regions with risk of severe infections [16] [17]. Most febrile cases are routinely diagnosed and treated for typhoid and/or malaria without proper investigation for other conditions including viral infections.

This study was carried out to determine the incidence rate of dengue fever among patients recruited in the Edna Adan University Hospitals in Hargeisa Somaliland.

We report an incidence rate of 37% for DENV among the patients

admitted to Edna Adan University Hospital. In Somaliland, it's the first that the dengue outbreak was reported from all regions of the country as declared by the ministry of health development of Somaliland.

The higher prevalence of dengue infection was noted among male patients than female patients unlike other reports in which both the sexes were equally affected. This is in agreement with similar studies conducted in Asia which suggested that infections are more frequent in men [14]. Other studies carried out in India (14) also suggest a higher prevalence of dengue infection among males than females. However, the biological bases for male-female differences in DENV infection rates remained undetermined

These findings confirmed the assumption that the Aedes species exists in all regions of the country and that the DENV virus is in circulation among Somali landers. The observed incidence rate of dengue in the current study however shows the need for improved intervention measures towards vector control and entomology studies in Somaliland to ascertain circulating mosquito species. However, given the impact of continued climate change, which supports the emergence and re-emergence of vector-borne diseases, the need to have a strong surveillance system is critically important.

The incidence rate of the current study findings is comparable to a similar study reported from India (31.5), [15], and Eritrea (33.3%), [16]. In contrast, a lower prevalence rate was also reported studies conducted in north-southern Nigeria, (18%), Jordan, (24.6%) [19], and Lagos, (24.9%) [17] Respectively.

**Table 2:** Frequency distribution of Dengue fever among patients with febrile illness admitted to Edna Adan University Hospital, Hargeisa, Somaliland (n= 54).

Gender	IgG	IgM	Both
Male	6(50%)	4(33.3%)	2(16.7%)
Female	4(50%)	3(37.5%)	1(12.5%)
Total	10(50%)	7(35%)	3(15%)

**Table 3:** Incidence rate of dengue fever by variables among patients admitted to Edna Adan University Hospital, 2023.

Dengue incidence rate				
Variables	Frequency	Percent %	Chi-square (X <sup>2</sup> )	p-value
<b>Participants Setting</b>				
Gender				
Male	25	46.30%		
Female	29	53.70%	<b>7.17</b>	<b>0.007</b>
<b>Age</b>				
Oct-20	6	11.10%		
21-30	11	20.40%	5.21	0.089
31-40	6	11.10%		
41-50	15	27.80%		
>50	16	29.60%		
<b>Resident</b>				
Urban	37	68.50%	1.94	0.164
Rural	17	31.50%		
<b>Chronic diseases</b>				
Yes	21	38.90%	3.46	0.63
No	33	61.10%		
<b>Presence or Absence of fever</b>				
Yes	37	68.50%	10.32	<b>0.001</b>
No	17	31.50%		
<b>Retro-orbital Pain</b>				
Yes	17	31.50%	15.1	<b>0</b>
No	37	68.50%		
<b>Myalgia</b>				
Yes	18	33.30%	1.94	0.163
No	36	66.70%		

Similarly, a higher incidence rate of DENV (86.6%) has been reported in a similar study conducted in Malaysia [18], Singapore (59%), [19] Pakistan (65.9%), [20], Venezuela (77.4%), [21], Saudi Arabia (47%), [20].

The reason for this difference in incidence rate between the previous studies and the current study may be due to various factors. Our study focused on the detection of IgG/IgM antibodies from acute febrile patients in the study area. Diagnostic tools also make a difference as there is a considerable discrepancy between the performances of the test being used.

As a cause of febrile illness, dengue virus infection is characterized by clinical features including high fever, headache, severe myalgia, nausea and vomiting and frequent rash. However, the predominant clinical signs and symptoms of the infection may vary with populations in different geographical regions [21].

In the current study, almost half (50%) of the study participants tested positive for dengue fever IgG. This result indicates that a large proportion of the population has been exposed to DENV during the DENV outbreak in the country.

This percentage of dengue IgG prevalence is higher compared to those studies conducted in Singapore (45%, [22] and Central Brazil (29.5%), [14]. These discrepancies may be due to the difference in the diagnostic performance of the employed laboratory methods.

With regard to associated factors with dengue virus, gender, presence of fever and retro-orbital pain were found significantly associated ( $p > 0.05$ ), and this is comparable with similar studies conducted in Kenya [23] and South Ethiopia [24] respectively.

## CONCLUSION

In conclusion, a high incidence rate of dengue virus infection (37%) was reported in the study area. Future large-scale investigation and molecular detection are warranted to discover different virus serotypes. This study also provides the first evidence of dengue virus infection circulation in Somaliland.

## AUTHORS CONTRIBUTION

HM conceived and designed the study, analyzed the data and wrote the manuscript. MA and ABK involved in data analysis, drafting of the manuscript and advising the whole research paper. HM also

were involved in the interpretation of the data and contributed to manuscript preparation. All authors read and approved the final manuscript.

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## CONFLICT OF INTEREST

The authors declare that they have no competing interest

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