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The Prevalence of Dengue Fever among Outpatients with Clinically Suspected Acute Febrile Illness Attending Kalkaal Hospital in Mogadishu, Somalia

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Abstract

Background: Dengue fever, a viral illness transmitted by mosquitoes, significantly increases morbidity and mortality rates, and its incidence has risen rapidly globally over the past two decades, posing severe public health challenges. This study aimed to determine the prevalence of dengue fever among patients with clinically suspected acute febrile illness at Kalkaal Hospital in Mogadishu, Somalia. ***Methods:*** This retrospective study involved patients who attended outpatient clinics at Kalkaal Hospital in Mogadishu (Somalia) between November 2022 and December 2023 to determine the prevalence of dengue fever among patients with clinically suspected acute febrile illness. Logistic regression data analysis was used. ***Findings:*** A total of 199,779 patients attended Kalkaal Hospital outpatient clinics during the study period. Of the 4,507 patients who showed dengue symptoms, 264 (5.9%) were positive. This study showed that patients aged <18 years were three times more likely to have dengue fever when compared with those aged ≥18 years (odds ratio: 3.33, 95% confidence interval: 2.57–4.31, $p < 0.001$). ***Conclusion:*** The study reveals a 6% dengue fever burden among study subjects, with males and those under 18 years old showing higher infection susceptibility. However, this is a single-center study, and future research involving more regions and hospitals may yield more conclusive results. Therefore, we recommend promoting dengue vector control surveillance.

Keywords: Dengue fever, infection, acute febrile illness, prevalence, virus.

INTRODUCTION

Dengue fever, the most common mosquito-borne viral infection worldwide, causes significant morbidity and mortality in tropical and subtropical regions [1], and its cases increased rapidly from 505,430 in 2000 to 5.2 million in 2019 (WHO). However, its actual number of cases is underreported, and many cases are misidentified as other febrile illnesses. Dengue virus infections are estimated to affect 390 million people annually, with 96 million clinically manifesting and 3.9 billion people at risk [2]. In Africa, between 1960 and 2010, dengue outbreaks were reported by 34 countries, mainly in East Africa, and 20 of the outbreaks were laboratory-confirmed [3]. Previous studies have reported dengue fever in Somalia [4,5]. In October 2022, the WHO emergency health updates reported a dengue fever outbreak in Mogadishu, which was not associated with deaths (case fatality rate: 0%) and involved 110 males (52.1%) and 101 (47.9%) females [2]. A comprehensive review and meta-analysis of dengue prevalence studies in Africa indicated that from 2000 to 2019, dengue IgG seroprevalence in Eastern and Western Africa was 3.6% and 52.6%, respectively [6].

The mosquito, *Aedes aegypti*, is the main dengue vector and is highly prevalent in tropical nations because of favorable climates and monsoons [7]. The burden of dengue is also increased by urbanization, lifestyle changes, and population migration [8]. Dengue virus, a flavivirus with four serotypes, is transmitted through the bites of infected female mosquitoes [9].

Within an incubation period of 8–12 days, the virus replicates in the mosquito's midgut and then spreads to secondary tissues. Dengue symptoms may develop within two days of Human-to-mosquito transmission [5]. The virus infects Langerhans cells, where it replicates and releases interferons that limit infection spread. When infected cells reach the lymphatic system, they trigger the immune system and cause viremia [1,5,6,10]. Dengue fever presents with symptoms like fever, malaise, chills, headaches, rashes, joint and eye pain, leucopenia, and thrombocytopenia [11].

Dengue virus infection is diagnosed using laboratory techniques like the detection of viral nucleic acids, antigens, or antibodies. However, serology is the preferred diagnostic method and dengue-specific IgM is detectable as early as day 4 of primary infections, while IgG and IgM antibodies emerge as early as day 2 of secondary infections [12]. Currently, there are no dengue antiviral drugs, and treatment is limited to early supportive care. The growing public health need for effective dengue prevention interventions necessitates vaccination and there are two licensed dengue vaccines [13]. In developing countries, dengue diagnosis is challenging because of the lack of standardized procedures and the risk of misdiagnosis because it may be confused with other febrile illnesses [4,11].

In Somalia, few studies have investigated dengue and there is limited evidence about its outbreaks. Moreover, no previous studies have evaluated its prevalence in Mogadishu, Somalia. This study aimed to determine the prevalence of dengue fever among patients with clinically suspected acute febrile illness at Kalkaal Hospital in Mogadishu, Somalia. This study's findings provide information on DENV (Dengue viral) infection and will raise community awareness, which may reduce the disease's morbidity rate and mortality. They may also guide policymakers to implement stronger approaches for dengue outbreak prevention.

METHODS

Study design

This retrospective study was conducted at Kalkaal Hospital in Mogadishu, Somalia. Data were collected from all patients (199,779) who attended outpatient clinics between November 2022 and December 2023. Of the patients, 4,507 were suspected dengue fever cases that presented with acute fever. However, only 264 (5.9%) were dengue fever positive.

Serological testing

Blood samples were collected in 4 mL sterile tubes and then centrifuged for 10 minutes to obtain serum. The sera were then tested using the Rapitest Dengue NS1 (Non-structural protein 1 antigen) &IgG/IgM cassette kit, an immunochromatographic assay that detects NS1 antigen and dengue virus-specific IgM and IgG antibodies in human serum, plasma, and whole blood. For the NS1 antigen rapid test, 100 µl of serum was placed on the NS1 rapid test strip, with a red test line color after 20 minutes indicating a positive result. For the IgM/IgG antibody test, 10 µl of the test serum was placed on an IgM/IgG antibody quick test strip, followed by the addition of two drops of the IgM/IgG buffer. A red test line color indicated positive results [14]. NS1 antigen detection simultaneously detects initial infections, as well as dengue virus-specific IgM and IgG. Screening test results were obtained within 20 minutes.

Data analysis

Data were analyzed using SPSS version 28 and descriptive and inferential analysis approaches were used. Age and gender demographic data were analyzed descriptively. Other demographic data were not available. Gender is presented as frequencies and percentages and age as mean ± standard deviation. The minimum and maximum age was also documented. Age distribution was visualized on a histogram. Logistic regression analysis was used to investigate the association between age, gender, and dengue fever presence. The level of significance was considered at 5%.

Findings

From November 2022 to December 2023, 199,779 patients attended Kalkaal Hospital's outpatient clinics, and of the 4,507 patients who presented dengue fever-like symptoms, 264 (about 6%) were dengue positive, while 4243 (94.1%) were negative.

Demographic variables

Age: The findings showed that the patients had an average age of 35.9 (standard deviation ± 21.3) years (range: four months to 110 years. Most patients were aged between 20 and 50 years (Figure 1).

Gender: About 58% of the patients (2,620) were female, while 41.9 % (1,887) were male (Figure 2).

Dengue fever prevalence: The prevalence of dengue fever was 5.9% (n = 264, confidence interval [CI]: 5.2%–6.6% (Figure 3).

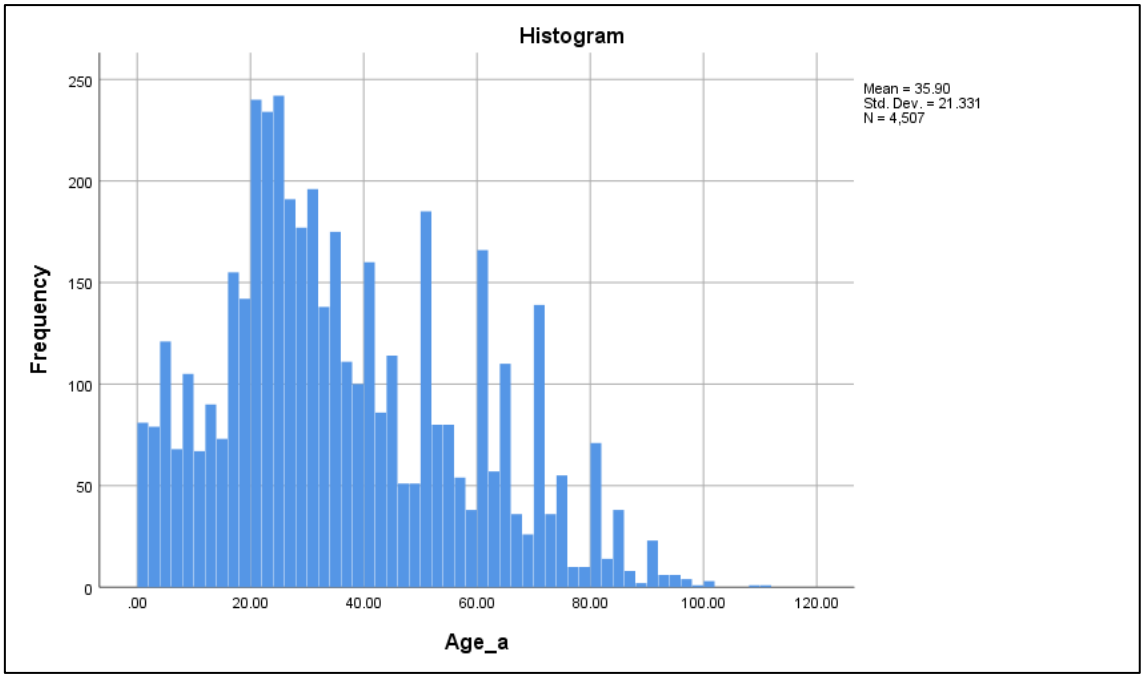

Figure 1: Age of the patients

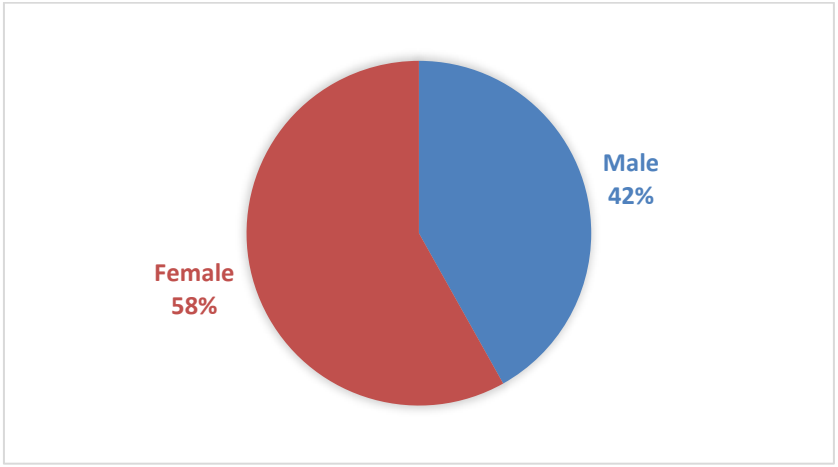

Figure 2: Gender

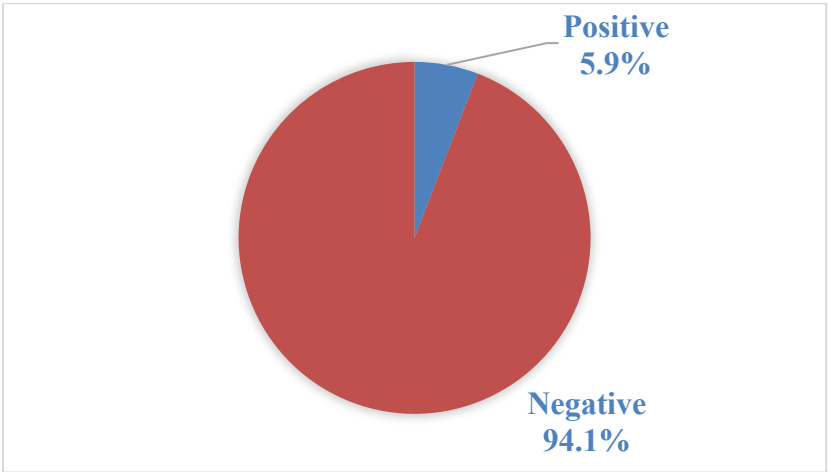

Figure 3: Prevalence of dengue fever

The association between age, gender, and dengue fever presence

Binary logistic regression analysis revealed that gender and age were significantly associated with dengue fever presence. When compared with females, male patients were 1.8 times more likely to have dengue fever (odds ratio: 1.81, 95% CI: 1.41–2.32, p < 0.001). Compared with those aged ≥18 years, patients aged < 18 years were thrice more likely to have dengue fever (odds ratio: 3.33, 95% CI: 2.57–4.31, p < 0.001) (Table 1).

Table 1: The association between age, gender, and dengue fever presence.

	Dengue fever				
	Total n	**Positive n (%)**	**Negative n (%)**	**p-value**	**OR (95% CI)**
Gender					
Males	1,887	147 (7.8)	1,740 (92.2)	< 0.001	1.81 (1.41–2.32)
Females	2,620	117 (4.5)	2,503 (95.5)		
Age					
<18 years	839	108 (12.9)	731 (87.1)	< 0.001	3.33 (2.57–4.31)
≥18 years	3,668	156 (4.3)	3,512 (95.7)		

DISCUSSION

Dengue fever prevalence was higher among those aged <18 years, which is consistent with the findings by Kuttoh [17]. Children may have been at an increased risk of infection because of immature immune systems, greater exposure to mosquito habitats during outdoor play, and potential unawareness about preventive measures. Efforts to reduce mosquito breeding sites in and around homes, such as stagnant water removal and the use of insecticide-treated bed nets, may protect children from dengue infection [15,16]. Our observation that male patients were more to get dengue fever than female patients is consistent with a Pakistan study that found that 81.1% and 18.9% of patients with dengue fever were male and female, respectively [9]. This is attributable to gender-specific behaviors and social roles, which might influence exposure to the dengue virus and risk of infection. For instance, males may engage in activities that increase exposure to mosquito bites, such as outdoor work or recreational activities, while females may spend more time indoors or take measures to avoid mosquito bites. Additionally, cultural norms and societal expectations may affect healthcare-seeking behavior and when compared with females, males may be less likely to seek medical attention for dengue symptoms. Prasith *et al*. reported similar findings [11].

The observation that about 6% of the study population had dengue fever is consistent with a Tanzanian study (5.2%) [10], and both this study and the Tanzanian study focused on populations that sought healthcare services. However, the current prevalence is lower than reported by Eldigail *et al*. [12], probably because of differences in the methodological approaches. The Eldigail *et al* study used a community-based approach and a study population including individuals aged ≥5 years old, while the current study was hospital-based and included all patients who sought care at a facility. Furthermore, the studies differ in timing and geographical location, which may lead to differences in dengue prevalence estimates. Factors like seasonal dengue transmission fluctuations, vector control variations, and prevalence differences in the dengue virus serotypes circulating in the population, may have influenced the observed prevalence. Also , a Kenyan study reported a higher prevalence (17.7%) [17].

CONCLUSSIONS

The present study has shown that the burden of dengue fever in Somalia among patients seeking outpatient services was 6 percent, which is predominantly lower compared to other studies conducted in the region. Therefore, this study revealed intermediate dengue fever prevalence, with males and those aged <18 years exhibiting higher infection susceptibility. However, this was a single-center study, and in the future, research involving more regions and hospitals may yield more conclusive results.

List of abbreviations

WHO: World Health Organization,
DENV: Dengue Virus,
CI: Confidence interval
NS1: Non-structural protein 1 antigen,
IgG: Immunoglobulin G,
IgM: Immunoglobulin M.

DECLARATIONS

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Authors' contributions

All authors have contributed equally for the preparation of this study including initiation of the data, analysis, and the writing manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author(s) on reasonable request.

Ethical approval

The study was approved by the Kalkaal Hospital ethics committee as per the local legislation and institutional requirements.

Consent for publication: Not applicable.

Competing interests: The authors declare that they have no competing interests.

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