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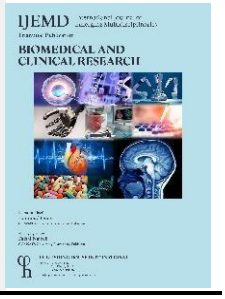

Knowledge, Attitude, and Practices Regarding Dengue Fever Prevalence Among Febrile Patients in Adamawa State, Nigeria

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ABSTRACT

Dengue fever (DF) is increasingly recognized as a significant viral infection with global public health implications. It causes morbidity and mortality, particularly in tropical and subtropical regions. Understanding the knowledge, attitudes, and practices related to dengue fever can provide valuable insights for efficient disease management. This study aimed to assess the level of knowledge, attitudes, and practices regarding dengue fever prevalence among febrile patients attending public health facilities in Adamawa, Nigeria. Six hundred sera were collected from febrile patients seeking medical attention in three selected hospitals across three Local Government Areas. A structured questionnaire capture socio-demographic information and risk factors. Sera samples were screened for Dengue virus (DENV) using enzyme-linked immunosorbent assay (ELISA). Odds Ratios (OR) were used to explore associations between seroprevalence and various variables. Among the 600 participants, 186 (55.9%) indicated awareness of DENV infection. However, 392 (69.9%) were completely ignorant of its existence. Individuals lacking knowledge about DENV transmission, symptoms, and fatality showed a significant association with DENV infection. Negligence regarding mosquito control and a preference for government responsibility in mosquito control were also linked to DENV infection ($P < 0.05$). This study highlights low economic status, ignorance, and negligence as predisposing factors for DENV infection in Adamawa State.

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Keywords: Dengue virus; Fatality; Negligence; Perception; Knowledge; Viral infection.

INTRODUCTION

Dengue fever (DF) is an arborviral disease that has emerged as a major public health concern worldwide, particularly in tropical and subtropical regions [1]. With an estimated 3.9 billion people at risk of infection across 129 countries, dengue poses a significant threat. In 2019, global dengue cases reached unprecedented levels, affecting regions previously unaffected, including Afghanistan [2]. Hospitalizations due to severe dengue (dengue haemorrhagic fever and dengue shock syndrome) account for approximately 500,000 cases annually, with a 5% fatality rate [3]. Additionally, the ongoing COVID-19 pandemic, coupled with other disease outbreaks, places immense strain on healthcare systems globally, potentially exacerbating the impact of dengue [4].
Dengue cases are substantially underreported within African health systems (5,6). This poses a greater concern for immunologically naive non-African populations. The burden of malaria often overshadows dengue, leading to neglect. Other neglected tropical diseases receive higher priority. Poor-resource settings hinder accurate identification of arboviral infections in Africa [7]. Diagnostic challenges contribute to misdiagnoses, with dengue cases often mistaken for malaria or labelled as fever of unknown origin [8].

Effective prevention requires addressing societal factors. Poor education, community perceptions, and crowded households play a role. Factors such as unscreened windows, lack of mosquito nets, improper waste disposal, and inadequate sanitation create favorable breeding grounds for *Aedes* mosquitoes (9,10). *Aedes* mosquitoes, responsible for dengue transmission, thrive in such environments [11]. Dengue seroprevalence among Internally Displaced Persons (IDPs) in the Northeast was reported at 74.4% [12]. Population displacement due to upheavals may have increased dengue spread in Adamawa State.

To achieve effective disease and vector control, communities must be equipped with knowledge about dengue prevention. Human behavior significantly influences virus spread and mosquito breeding [10]. Optimal socioeconomic status and better perception of dengue contribute to successful disease control. These steps are crucial, especially in underdeveloped nations like Nigeria [13]. Given the rising cases of dengue fever in Nigeria, our study aims to assess the prevalence of dengue virus in relation to the knowledge, attitude, and perception of febrile patients in Adamawa State.

MATERIALS AND METHODS

Study Area: Adamawa State, Nigeria

Adamawa State is situated between latitude 9°45'06''N and 10°19'60''N, as well as longitude 12°03'18''E and 13°29'59''E. The state features diverse topography, including mountainous landforms such as the Mandara Mountains, Cameroon Mountains, and Adamawa hills. Additionally, it is intersected by major rivers such as Benue, Gongola, and Yadzarem, creating water puddles and discarded containers due to human activities. These water sources serve as suitable breeding sites for *Aedes* mosquitoes, which are responsible for dengue transmission [14].

Adamawa State experiences seasonal flooding and has swampy terrain, particularly during the rainy season. The mean annual rainfall varies from 700 mm in the northern part of the state to 1600 mm in the southern part. Notably, the state faces unique environmental conditions that contribute to mosquito proliferation and disease transmission [14]. For this study, purposive sampling was employed to select three out of the 21 Local Government Areas (LGAs) within Adamawa State. The chosen LGAs include Mubi North, Yola North, and Numan (Fig. 1).

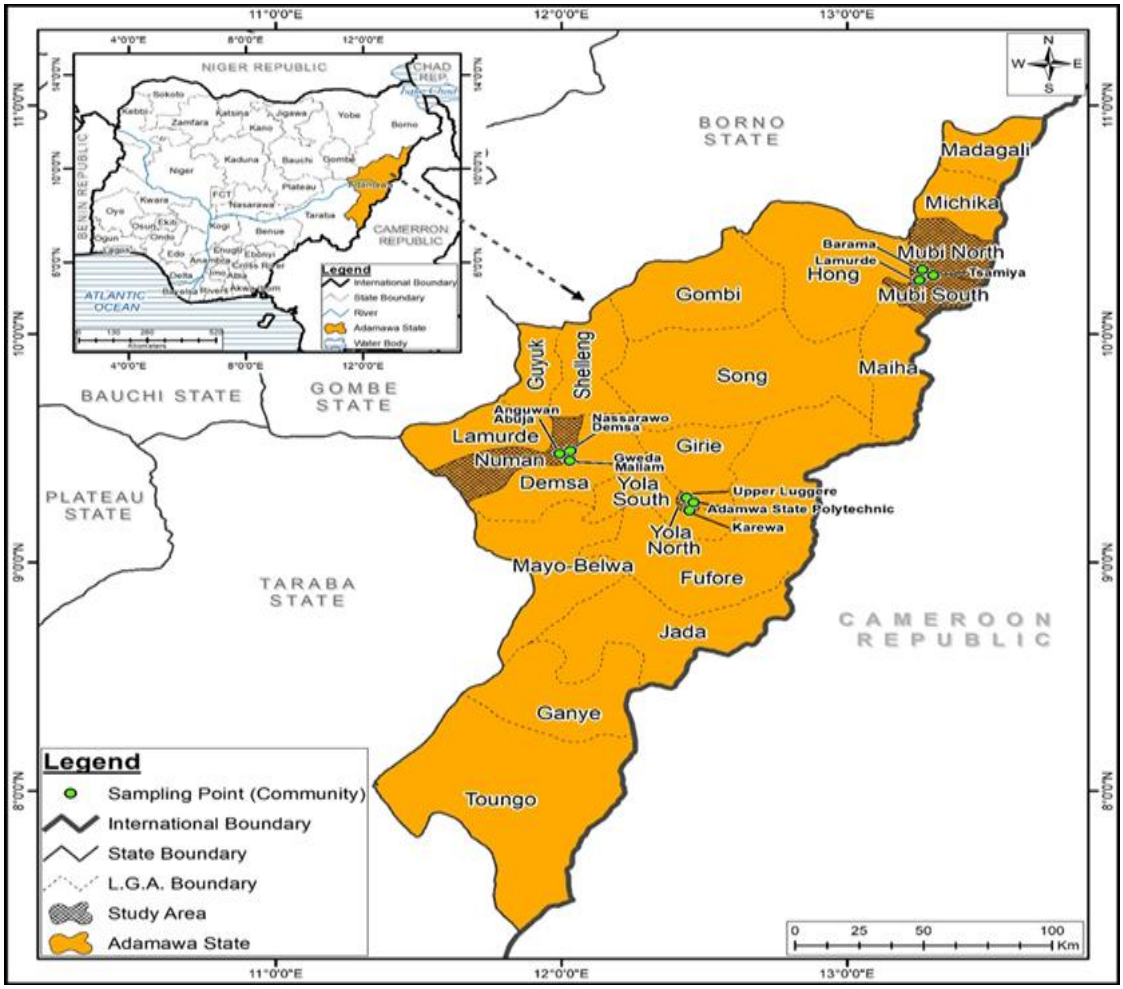

Fig.1: Sampling locations in Adamawa State

(Source: Modified from the Administrative Map of Nigeria)

Study Population and Data Collection

The study included both male and female febrile patients aged 1 to 90 years who sought medical attention at three selected hospitals in Adamawa State. Patients were chosen based on convenience sampling, considering their availability and consent.

Ethical Clearance:

Ethical approval was obtained from the Ethical Committee of the Adamawa State Ministry of Health and the Ahmadu Bello University Ethical Committee on the Use of Human and Animal Subjects for Research (Ref. N0. S/MoH/1131/1 and ABUCUHSR/2017/004). Written informed consent was obtained from adult participants, parents, and guardians for children.

Inclusion and Exclusion Criteria:

Inclusion Criteria:

Patients aged 1 to 90 years presenting with symptoms such as fever (>38°C), severe headache, neck and back pains, and abdominal pain in the selected hospitals. Parents and guardians provided consent for children's participation.

Exclusion Criteria:

Patients who did not consent to the study and those who did not exhibit febrile symptoms.

Data Collection Using Questionnaires:

Trained interviewers administered a self-designed structured questionnaire to febrile patients. The questionnaire aimed to gather information on knowledge, attitude, and perception related to dengue fever.

Blood Sample Collection and Processing:

Phlebotomists collected 5 milliliters (5 ml) of blood from consenting patients attending public health facilities. Blood samples were placed in clean, labeled sample bottles and allowed to clot at room temperature (25°C). Serum was obtained by centrifuging each blood sample at 1000 rpm for 10 minutes. All serum samples were transported in a cold box and stored at -20°C in the Parasitology and Entomology Laboratory of the Department of Zoology, Ahmadu Bello University, Zaria, until analysis.

Detection of IgM Antibodies by Enzyme-Linked Immunosorbent Assay (ELISA)

Febrile patients' serum was tested using an ELISA kit (Diagnostics Automation/Cortez Diagnostics, Inc., Woodland Hills, USA) following the manufacturer's instructions. Samples and reagents were brought to room temperature (15-25°C) before use. A 96-well microplate was labeled for controls, samples, and reagent blank. Enzyme conjugate was added to the wells and incubated. After washing, substrate (Tetramethyl-benzidine) was added, and the optical density (OD) was measured at 450 nm. An OD ratio

of 0.3-1.0 indicated a negative result, while greater than 1.0 indicated a positive result (presence of antibodies against DENV).

Data Analyses

The collected data from the questionnaire and the laboratory test results were analyzed using Statistical Package for Social Sciences (SPSS) software (version 24 for Windows; SPSS Inc., Chicago, IL, USA). Odd ratios (OR) were used to assess the association of various variables with dengue virus detection using Epi-InfoTM. Descriptive statistics were employed to determine the prevalence of dengue in the human population. All data underwent analysis, and significance was set at $p < 0.05$.

RESULTS

The IgM detection of DENV infection, based on participants' knowledge and perception, is summarized in Table 1. Here are the key findings: Knowledge of DENV Existence: 186 participants (55.9%) were aware of the existence of DENV infection while 392 participants (69.9%) were completely ignorant of it. A significant association was observed ($\chi^2 = 10.292$, $p = 0.001$) in ignorance and dengue virus infection. Lack of knowledge about DENV increased the likelihood of infection (OR = 1.831, 95% CI = 1.276-2.627).

The highest prevalence (71.8%: 252/351) occurred among participants unaware of DENV transmission modes. Lower infection rates (50.0%: 1/2) were observed among those who believed transmission occurred via other insects. Significant association was also found ($\chi^2 = 13.401$, $p = 0.000$) among participants unaware of DENV transmission modes. Lack of awareness about transmission increased infection risk (OR = 2.017, 95% CI = 1.395-2.917) – Table 2.

Participants lacking knowledge of DENV symptoms had higher prevalence (71.7%: 268/374). Those aware of symptoms showed lower infection rates (55.2%: 91/165). Significant association existed ($\chi^2 = 13.292$, $p = 0.000$). Lack of symptom awareness increased infection likelihood (OR = 2.056, 95% CI = 1.405-3.008).

Higher prevalence (70.8%: 250/353) occurred among those ignorant of DENV's fatality in table 3. Lower prevalence (58.9%: 103/175) was observed among those aware of its severity. Significant association was noted ($\chi^2 = 7.028$, $p = 0.008$).

Majority (81.6%: 93/114) preferred government responsibility for mosquito control in table 3. Fewer participants (61.11%: 165/270) believed individuals should be responsible. Significant association existed ($\chi^2 = 16.196$, $p = 0.000$). Those favoring government control had a higher infection likelihood (OR = 2.84, 95% CI = 1.706-4.728).

Most participants (93.8%: 531/566) expressed interest in attending a workshop. A small minority (6.2%: 35/566) were uninterested (Figure 1). Participant's willingness to attend awareness campaign on dengue.

Table 1: Distribution of dengue virus among the participants according to the Knowledge of dengue fever and its fatality

Variables	No. examined	No. positive (%)	χ^2	p-value	OR	95%CI
Knowledge of dengue fever						
Yes	186	104 (55.91)	10.292	0.001	0.546	0.381-0.784
No	392	274 (69.89)		0.001	1.831	1.276-2.627
Missing data	22					
Total	600					
Dengue fever fatality						
Yes	175	103 (58.86)	7.028	0.008	0.589	0.404-0.861
No	353	250 (70.82)		0.008	1.697	1.162-2.478
Missing data	72					
Total	600					

Note: The analysis did not include the missing data

Table 2: Distribution of dengue virus among the participants according to the Knowledge of Symptoms and Mode of Transmission of Dengue infection

Mode of Transmission of dengue	No. examined	No. positive (%)	χ^2	p-value	OR	95%CI
Aedes mosquito	147	82 (55.78)	9.110	0.003	0.539	0.365-0.797
Other insects	2	1 (50.00)	0.000	1.000	0.509	0.032-8.198
Air borne	27	14 (51.85)	1.974	0.160	0.532	0.245-1.158
Water borne	14	9 (64.29)	0.000	1.000	0.918	0.303-2.780
Don't know	351	252 (71.8)	13.401	0.000	2.017	1.395-2.917
Missing data	59					
Total	600					
Symptoms of dengue fever						
Yes	165	91 (55.15)	13.292	0.000	0.486	0.333-0.712
No	374	268 (71.66)			2.056	1.405-3.008
Missing data	61					
Total	600					

Note: The analysis did not include the missing data

Table 3: Attitude of febrile patients towards mosquito control

Mosquito control responsibility	No. examined	No. positive (%)	χ^2	p-value	OR	95%CI

Government	114	**93 (81.58)**	16.196	**0.000**	2.840	1.706-4.728
Individual	270	165 (61.11)	46.073	0.000	0.208	0.130-0.333
Both	177	111 (62.71)	0.888	0.346	0.821	0.566-1.191
Missing data	39					
Total	600					

Note: The analysis did not include the missing data

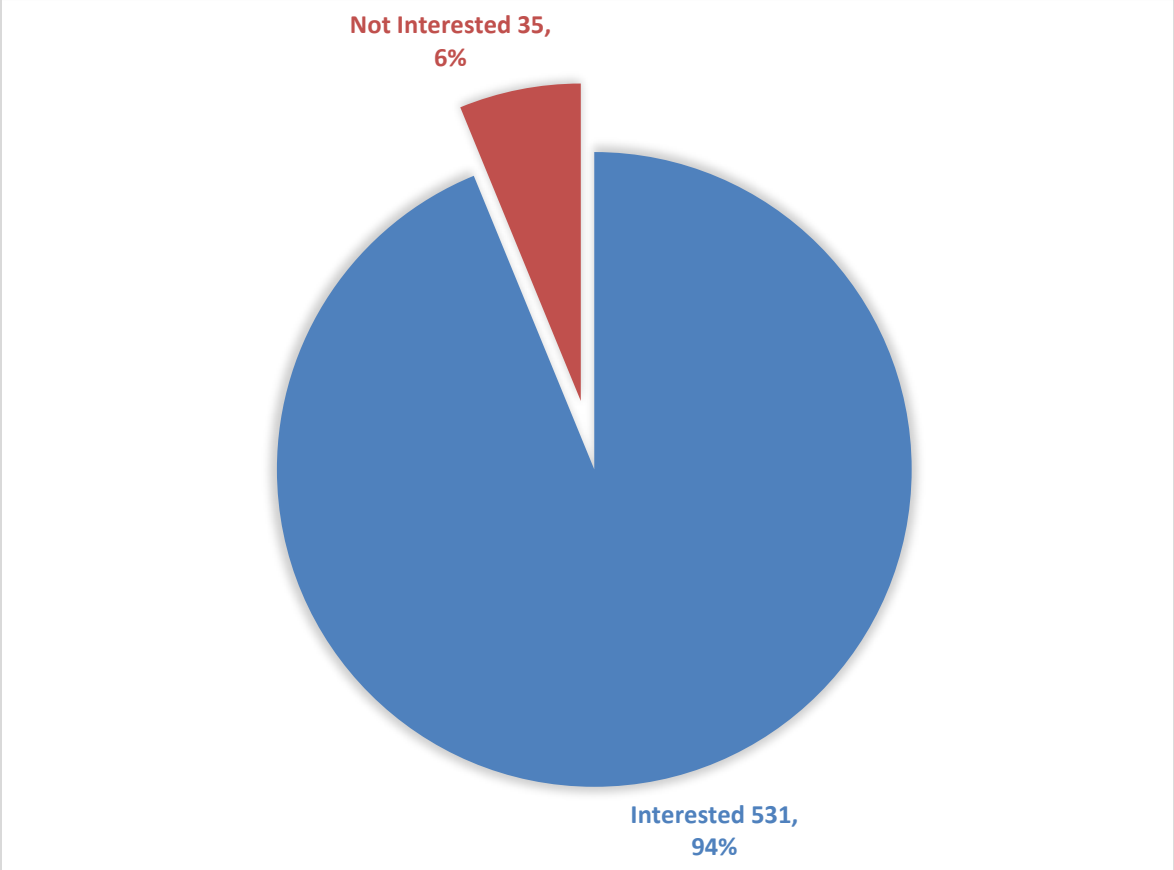

Fig. 2: Percentage of Participant's willing to attend awareness campaign on dengue

DISCUSSION

The study revealed significant gaps in the knowledge of febrile patients regarding dengue infection and its associated vectors in Adamawa State. Adequate knowledge about dengue transmission and symptoms is crucial for effective disease control before, during, and after outbreaks. Here are the key findings and their implications. Dengue infection was found to be significantly associated with lack of knowledge of DENV and the vector that transmit it. A substantial number (69.9%) were completely ignorant of it. This aligns with previous research in Nepal, where only 12% of participants understood the cause of dengue fever (15).

Furthermore, participants unaware of DENV transmission modes had the highest prevalence. Those believing in other modes of transmission had lower infection rates. Lack of awareness about transmission increased the likelihood of infection. Similar findings were reported in Tanzania by Kazaura (16), emphasizing the need for better education on dengue transmission. Participants lacking knowledge of DENV symptoms showed higher prevalence (71.7%). Those aware of symptoms had lower infection rates (55.2%). Lack of symptom awareness increased the risk of infection. This highlights the importance of recognizing dengue symptoms early for timely intervention. It has become clearer now that the high cases of DENV infection observed in Adamawa could be attributed to less apparent knowledge of DENV infection and its mode of transmission. The implication is that, the people might continue to indulge in behaviors considered to be risk factors for DENV infection and will continue to spread the DENV which could apparently result in epidemics.

Significant and higher prevalence occurred among those ignorant of DENV's fatality while lower prevalence was observed among those aware of its severity. Understanding the potential severity of DENV infection is critical for preventive measures. Nonetheless, knowledge of fatality and compliance with the recommended preventive guidelines is central to the fight against DENV infection. Nevertheless, insufficient understanding of the etiology and effect of the disease can negatively impact on the necessary precautionary measures (17). Thus, the victim may continue to transmit the virus via the aids of *Aedes* species to other people which could eventually results to dengue complication such as DSS and DHF. This may likely become a major public health problem in Nigeria in the nearest future since dengue virus was also isolated in *Aedes* mosquitoes in the study area.

Additionally, most of the participants preferred government to be responsible for the mosquito control in their communities. This indicates human behaviour and attitudes in respect to mosquitoes control in the study area. This might have been responsible for the high rate of DENV infection reported. This could also be case of sheer negligence and to an extent the level of exposure of the study participants. The people could have averted the high prevalence obtained by observing simple *Aedes* mosquitos control activities such as fumigation, storage of water in closed containers, discarding of trash cans and used tyres, cleaning of clogged gutters, drainages and vegetation. Hence this study confirmed the report by Okwa (18) who reported negligence of individuals in the control of mosquito in Nigeria. Therefore, public health policies should prioritize effective mosquito control strategies.

The majority of participants expressed interest in attending a workshop. World Health Organization stated that community engagement is key for a sustained vector controls strategy (2). This study reveals the possible cooperation of the community for public health education. Raising awareness through campaigns can empower communities to combat dengue.

In addition, addressing knowledge gaps and promoting accurate information about dengue is essential. Failure to prioritize DENV prevention could lead to continued transmission and potential epidemics. Considering the socioeconomic context and the prevalence of DENV in Adamawa State, targeted educational efforts are crucial. Additionally, understanding the fatality of DENV infection and compliance with preventive guidelines are vital for effective disease control.

CONCLUSION

The study revealed significant associations between DENV infection and various factors among patients in Adamawa State: Participants unaware of DENV transmission modes had the highest prevalence (71.8%). Lack of knowledge increased the likelihood of infection (OR = 2.017; 95% CI = 1.395-2.917). Participants who did not know DENV symptoms showed higher prevalence (71.7%). Lack of symptom awareness increased the risk of infection (OR = 2.056; 95% CI = 1.405-3.008). Higher prevalence occurred among those ignorant of DENV's fatality (70.8%). Understanding the severity of DENV is crucial for preventive measures (OR = 1.697; 95% CI = 1.162-2.478). Participants favouring government responsibility had a higher prevalence (81.58%). Those believing in individual responsibility had a lower infection likelihood (OR = 2.840; 95% CI = 1.706-4.728). These findings emphasize the importance of education and awareness campaigns to combat dengue and promote effective preventive measures.

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Authors' contributions

II and MA conceived and designed the study. II and BK conducted the field data collection, performed the laboratory and data analysis under the supervision of ISN MA and AYS. II drafted the manuscript, ISN, MA and AYS critically revised the manuscript.

Conflicts of Interest

The authors declare that they have no competing interests.

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