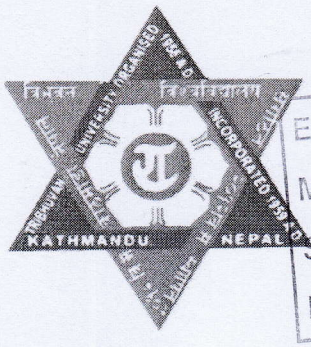
PREVALENCE OF DENGUE AMONG SUSPECTED PATIENTS VISITED AT NOBEL MEDICAL COLLEGE TEACHING HOSPITAL, BIRATNAGAR, NEPAL



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Science in Zoology with special paper Parasitology

Submitted to

Central Department of Zoology
Institute of Science and Technology
Tribhuvan University
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March, 2023

DECLARATION

I hereby declare that the work presented in this thesis has been done by myself, and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by reference to the author(s) or institution(s).

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RECOMMENDATION

This is to recommend that the thesis entitled **"PREVALENCE OF DENGUE AMONG SUSPECTED PATIENTS VISITED AT NOBEL MEDICAL COLLEGE TEACHING HOSPITAL, BIRATNAGAR, NEPAL"** has been carried out by Juli Jha for the partial fulfillment of Master's Degree of Science in Zoology with special paper Parasitology. This is her original work and has been carried out under my supervision. To the best of my knowledge, this thesis work has not been submitted for any other degree in any institutions.

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LETTER OF APPROVAL

On the recommendation of supervisor "**Prof. Dr. Mahendra Maharjan**" this thesis submitted by Juli Jha entitled **"PREVALENCE OF DENGUE AMONG SUSPECTED PATIENTS VISITED AT NOBEL MEDICAL COLLEGE TEACHING HOSPITAL, BIRATNAGAR, NEPAL"** is approved for the examination in partial fulfillment of the requirements for Master's Degree of Science in Zoology with special paper Parasitology.

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CERTIFICATE OF ACCEPTANCE

This thesis work submitted by Juli Jha entitled **"PREVALENCE OF DENGUE AMONG SUSPECTED PATIENTS VISITED AT NOBEL MEDICAL COLLEGE TEACHING HOSPITAL, BIRATNAGAR, NEPAL"** has been approved as a partial fulfillment for the requirements of Master's Degree of Science in Zoology with special paper Parasitology.

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Juli Jha

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LIST OF ABBREVIATIONS

Abbreviated form	Details of abbreviations
DENV	Dengue virus
DF	Dengue fever
Fig	Figure
IgG	Immunoglobulin G
IgM	Immunoglobulin M
KAP	Knowledge, attitude, practice
NMCTH	Nobel Medical College Teaching Hospital
NS1	Non Structural Protein 1
RDT	Rapid diagnostic test
SEA	South East Asia
WHO	World Health Organization

ABSTRACT

Dengue fever (DF) is caused by the dengue virus (DENV), of which there are four different serotypes (DENV-1, DENV-2, DENV-3, and DENV-4) and is transmitted by the principal vectors *Aedes aeypti* and *Aedes albopictus*. The morbidity and mortality due to dengue are increasing in most countries. In order to assess the prevalence of disease among suspected patients visiting Nobel Medical College Teaching Hospital of Biratnagar, Morang, Nepal, along with the knowledge, attitude, and practices (KAP) of the infected patients. A total of 1198 suspected patients visiting hospital were diagnosed with dengue fever using an antigen-antibody rapid diagnostic test for a period of six months (5^{th} Jesth to 15^{th} Kartik, 2076). Among 1198 suspected cases, overall dengue prevalence was found to be 137 (11.43%). In case of sex, out of 720 males, 89 (12.36%) were dengue positive, and out of 478 females, 48 (10.04%) were dengue positive. The age group 21-30 years (25.54%) was the most infected, while the age group >51 years (9.48%) were the least infected. The highest prevalence was recorded during the month of Ashad (19.67%). Similarly, according to the antigen/antibody test, NS1 positives (70%) were more common than IgM positives 25 (18.2%) and IgG 8(6%). In case of district-wise prevalence, among 137 positive cases, the highest was found in Sunsari (54.03%), followed by Morang (38.7%), and the least was seen in Mahottari (only 0.72%). Among 137 positive cases among ethnic groups, Brahmins (55.14%) and Chettris (24.08%) were found to be more infected than others. The results of the questionnaire survey indicated that awareness of the disease and knowledge of its symptoms were good among infected people. Similarly, the preventive practices for the disease that people followed seem good. Hence, disease conditions are still worsening the lives of the people in this area. In order to reduce the disease burden, community-focused awareness and preventive programming need to be initiated as soon as possible.

1. INTRODUCTION

1.1 Background

Dengue fever (DF) is caused by dengue virus(DENV) and there are four different serotype of dengue virus(DENV-1, DENV-2, DENV-3 and DENV-4) (Seitz, 2011). This disease is transmitted to human by the bite of mosquito vectors primarily *Aedes aegypti* and *Aedes albopictus* in most of the countries (Kraemer, et al. 2015). Dengue fever is caused by the dengue virus (DENV), which belongs to the genus Flavivirus of the family Flaviviridae (Gubler, 2002). The disease has been recorded in 129 countries, with a high disease burden in Asia, Africa, and Latin America, and almost half of the world's population residing in dengue risk zones; among them, 3.9 billion people are at risk of dengue fever (Brady *et al., 2012*). DF infection rate from 2010 to 2019 increased from 2.4 million to 5.2 million, along with an increased death rate of 960 to 4032 in 2010 and 2015, respectively (WHO, 2019). Among them, the motality rate was high among younger-aged children, but the morbidity and motality rate of DF were found to have decreased during the years 2020 and 2021 (WHO, 2021).

Southeast Asia accounts for about 52% of the total disease burden (Stanaway *et al*., 2016). About 1.3 billion people live in dengue-endemic countries in Southeast Asia, and dengue is the leading cause of hospitalization and death mainly among children in the region (WHO, 2011). The reported incidence of Southeast Asia by country varies as it includes either laboratory-confirmed, probable, or suspected cases (Shepard *et al*., 2013). However, data compiled by WHO clearly show a generalized spread of dengue fever in Southeast Asia over the past decade (Shepard *et al*., 2011). In 2003, eight SEA countries reported dengue cases, and by 2009, all SEA member states except North Korea had reported their own cases (WHO, 2012). Epidemics continue to exist in regular cycles of 3–5 years across the SEA, and the number of reported cases continues to increase with the severity of cases in many member states (Gubler *et al*., 2011). In 2010, a total of 187,333 dengue cases were reported to WHO from this region (Ferreira et al., 2012). Eight SEA countries are currently classified as hyperendemic, with all four dengue virus serotypes present; severe dengue fever is endemic in most SEA countries, and there have been severe dengue outbreaks in the region. The rate is 18 times higher than in the United States (Shepard *et al*., 2013).

With many cases of dengue infection occurring in the Philippines and Thailand in the 1950s and transmission becoming so widespreadin the next two decades, dengue fever is now a major cause of childhood morbidity and mortality in manypartsof the world, especially in India (WHO, 2009). In addition, there was a significant increase in the incidence of dengue fever in the western Pacific islands during the same period (Clark *et al*.,1998)**.** At the beginning of this century, the disease occurred in Bangladesh, Bhutan, and Nepal (Dorji *et al*., 2009). Since then, dengue epidemics have worsened worldwide, with the WHO reporting an exponential increase in the average annual number of DF/DHF cases every decade since 1960 (Rahman *et al*., 2002).

Available outbreak data suggest that 22 African countries reported sporadic cases or outbreaks between 1960 and 2010**,** and 22 of these countries reported localized disease**.** transmission, 20 laboratory-confirmed cases, and only 2 clinical cases (Kuritsk *et al*., 2011). A 2011 review of existing databases and literature indicates that dengue transmission is endemic in 34 countries in the African region. In the remaining 12 countries, there were no 'local' reports of dengue, only travelers returning from non-endemic countries (Rigau-Perez *et al.,* 1998). Although all four dengue virus serotypes have been observed in Africa, most epidemics appear to have been caused by DENV-2 (Endy *et al.,* 2011). Notably, in 2009, there were more than17,000 large-scale dengue outbreaksin the Cape Verde archipelago, associated with DENV-3 (Franco *et al.,* 2010).

The last reported dengue epidemic in Europe occurred in Greece between 1926 and 1928 (Halstead *et al*., 1997). This epidemic suggests that *A. aegypti* was the dominant vector and that A. albopictus became established in Europe in the 1990s as a result of increased global trade in used tires (WHO 2013). Imported cases in travelers were frequently observed**,** and local transmission of dengue was reported in both Croatia and France in 2010 (Gubler, 1997). Portugal's Madeira Archipelago has been in the midst of an outbreak since October 2012. This outbreak brought him 2164 cases by February 2013, and his 78 imported cases were detected by recent travelers to Madeira in 13 other European countries (EDCD, 2013).Although Europe had been dengue-free for most of the 20th century, the global spread of dengue eventually affected the region.

The first DF case in Nepal was reported in 2004 in Chitwan, when a Japanese visitor stayed for several weeks and then got checked up in their country and found DENV-2 positive (Pandey *et al.*, 2004). While the first dengue outbreak was reported from the lowland areas in 2006 with the circulation of all four dengue serotypes (Malla *et al., 2008*), Since 2006, Nepal has continued to experience DF outbreaks with increasing cases from the lower altitudes up to the hilly regions, with a significant impact on public health (Acharya *et al.,* 2018). In 2019, Nepal experienced a large dengue outbreak with more than 17,000 reported cases from the lowland areas (1500 m above mean sea level) to the highland areas (> 1500 m) (Phuyal *et al., 2020*). However, the majority of cases until 2018 have been reported from the lowland areas (1500 m), which are densely populated (Gyawali *et al., 2020*) with known distribution of *Aedes* vectors, i.e., *Aedes albopictus* and *Aedes aegypti* (Dhimal *et al., 2014*). The frequent outbreaks of DF and the rising number of dengue cases in Nepal suggest that the vector control efforts are probably ineffective or insufficient and are conducted exclusively as part of an emergency response to outbreaks (Griffiths *et al., 2013*). In the meantime, the vaccines are unavailable in Nepal and also do not protect against all serotypes of DF (Biswal *et al*.,2019).Furthermore, a person may be infected with dengue multiple times, ultimately increasing the risk of severe dengue infection (Oishi *et al*., 2007). In the absence of an effective vaccineor specific antiviraltreatment,vectorprevention and control strategies have helped minimize the increase in dengue outbreaks and the severity of dengue epidemics (WHO, 2011). Community engagement can provide a more cost-effective approach, thus enabling more sustainable interventions to reduce dengue (EDCD, 2020). On the other hand, altering general human behavior is one of the strategies currently employed to reduce dengue virus vector populations and transmission (Barrera *et al*., 2011). However, it is important to consider that different ethnic groups with different socioeconomic and cultural backgrounds live at different altitude gradients in Nepal (Dhungana and Yamphu, 2016). Therefore, to improve and design sustainable public health interventions against dengue with people from different socioeconomic and cultural backgrounds at different altitudes in Nepal, it isnecessary to combine people's knowledge, attitudes, and practices**.** It is imperative to know and recognize (KAP) aboutviruses and their vectors (Wong *et al*., 2014). Some of his knowledge, attitude, and practice studies have been conducted in Nepal, but these are limited to specific

dengue endemic areas (KC *et al*., 2017) or focus only on dengue-infected persons (Neupane *et al*., 2017).

1.2 Objectives of Study

1.2.1 General Objective

Prevalence of dengue among suspected patients visited at Nobel Medical College and Teaching Hospital, Biratnagar, Nepal.

1.2.2 Specific Objectives

i. To determine the demographic and clinical characteristics of dengue among suspected patients in Nobel Medical College Teaching Hospital, Biratnagar, Nepal.
ii. To assess the knowledge, attitude and practices regarding dengue disease among dengue patients.

1.3 Significance of the Study

Dengue is re-emerging endemic disease in Nepal with increasing burden and geographic spread over the years. The trend of dengue on the basis of age, sex, ethnic group and district of this region during six month of 2019 was analyzed and KAP was also assessed among positive patients. Hence the findings of this study will help to review the current dengue elimination policy of the government in this region in coming days.

2. LITERATURE REVIEW

Dengue fever is a mosquito-borne viral disease affecting tropical and subtropical countries of the world where *Aedes aegypti* and/or *Aedes albopictus* are abundant (Guzman and Kouri, 2002). These day-biting mosquitoes are most active during the period between two hours after sunrise and several hours before sunset (Gubler, 1998)

Global scenario of dengue

Global estimates vary, but regularly approximate 50 million to 200 million dengue infections, 500,000 episodes of severe dengue (DHF/DSS), and over 20,000 dengue-related deaths occur annually (Shepard *et al*., 2011). Eight countries in Southeast Asia (SEA) were classified as hyperendemic with all four dengue virus serotypes present (WHO, 2011). Severe dengue is endemic in most SEA countries; compared with America, it is 18 times higher (Shepard *et al*., 2013). The first record of a case of probable dengue fever was mentioned in a Chinese medical encyclopedia from the Jin Dynasty (265–420 AD) (Gubler, 2006). Evidence indicates the first noted presence of mosquito viruses was in the forests of Asia and/or Africa, with major epidemics in humans occurring in Asia, Africa, and North America during the 1780s (Gubler, 1998). A study in London by Howe (1997) in the early and mid-20th century found that after World War II, dengue spread globally.

According to Ferreira (2012), on the global dengue epidemiology trend, up to 3.6 billion people are estimated to now live in tropical and subtropical areas where the dengue viruses have the potential to be transmitted. According to Bhatt *et al. (2013),* about 129 countries and nearly 50% of the world's population are at risk of DF, and among them, Southeast Asia and the Western Pacific countries are known to be the most endemic regions. Semenza et al. (2014) reported that earlier studies in Europe, Australia, and Japan reported various dengue cases imported from endemic regions. In a study of dengue infection in Korean travelers conducted by Je *et al. (2016*) analyzing national surveillance data from 2011 to 2015, males aged 20–29 years were considered the highest risk group. Abdu *et al. (2022) found that* in Brazil, epidemiological trends were seen in increasing order, with the highest rates in 2015, 2016, and most in 2019, and regarding gender, 0.6% were female and 32.1% were

male. In terms of gender, the age-standardized incidence rate per 100,000 for male and female was basically similar from 1990 to 2019, but the incidence rate for female was slightly higher (Tian et al., 2022). According to Epidemiology of Dengue in SAARC Territory by Shrestha *et al. (2022):* 30.7% were confirmed dengue cases in which IgG, IgM, or both (IgM and IgG) antibodies and dengue NS1 antigen were 34.6, 34.2, 29.0, and 24.1%, respectively. Among the different strains of dengue, dengue virus (DENV 1-4) strains accounted for 21.8, 41.2, 14.7, and 6.3%, respectively.

Amarasinghe *et al*.(2011), in their paper on dengue virus infection in Africa, note that since the 19th century, dengue epidemics have been reported in countries including Zanzibar (1823, 1870), Burkina Faso (1925), Egypt (1887, 1927), South Africa (1926–1927), and Senegal (1927–1928). All four dengue virus (DENV) serotypes have been isolated in Africa,with DENV2 reported to cause the most epidemics. The principal vector for dengue fever, *A. aegypti*, originated in Africa and spread throughout the continent (Gubler *et al*.,1979).There are other Aedes species present on dengue virus infection in Africa, note that since the 19th century, dengue epidemics have been reported in countries including Zanzibar (1823, 1870), Burkina Faso (1925), Egypt (1887, 1927), South Africa (1926–1927), and Senegal (1927–1928). All four dengue virus (DENV) serotypes have been isolated in Africa, with DENV2 reported to cause the most epidemics. The principal vector for dengue fever, A. aegypti, originated in Africa and spread throughout the continent (Gubler et al., 1979). There are other Aedes species present in Africa Africa, which also act as potential vectors, including *A. albopictus*, *A.africanus*, and *A. luteocephalus* (Diallo et al., 2008).

According to Ahmed *et al*. (2019), in Europe during 2015, the United Kingdom and France had the highest rate of severe dengue (95% CI) with mostly serotype 2, and for prevention, European health authorities should pay more attention to the diagnosis and control of dengue infection among returning travelers, especially those with fevers of unknown origin. Among the 309 patients reported in Europe by Jelinek *et al*. (2002, 72.1% confirmed cases), 212 (72.1%) had a combination of fever, headache, fatigue, and musculoskeletal symptoms.

In South Asia, Tian *et al*.(2022) found that dengue burden among the Maldives, India,India and Sri Lanka from 1990 to 2019 were much higher than expected, and in South-East Asia, prevalence in Indonesia (85.96%) from 1990 to 2019 was much higher, followed by the Phillipines (72.15%). In India, Chandi (2020) performed a Chattishgharh RDT test on 1308 samples, and 412 (31.5%) were found to be positive for dengue fever, with the highest rate in August, with males (28.1%) and females (39.5%) mostly 10-20 years old (55.83%).Also in India, in Uttarpradesh, a study was conducted by Kumar *et al.* (2022*)* that shows the positivity rate was 27.29% (1489/5457) and the peak of cases was reported in October.

According to Gubler (1998) in the paper on dengue and dengue hemorrhagic fever, dengue mainly occurs due to uncontrolled population growth, increased air travel, insufficient public health care facilities, ineffective vector control, unplanned urbanization, changes in environmental factors, host–pathogen interactions, population immunological factors, and also due to the movement of people, which are some of the important factors that promote dengue infection, making it a global pandemic.

National context

Pandey *et al.* (2004*),* the first case of dengue virus infection in Nepal, reported that dengue was free until the first recognized suspected incidence in 2004 that was seen in a Japanese worker who visited Nepal and stayed for several months and tested positive for dengue virus-2 on his return to his home country. Rijal *et al. (2020),* in the paper Epidemiology of Dengue Viral Infection in Nepal, report a total of 17,992 dengue cases in 68 districts of Nepal in 2019 (Incidence Rate Ratio (IRR): 4.8; 95% CI: 1.5–15.3), which is over 140 times higher than in 2018. In 2013, Gupta *et al. found that o*ut of 4 hospitals, the highest positive cases were in Tanahu District Hospital, Damouli (23.8%), followed by Koshi Zonal Hospital, Biratnagar (12.5%), with higher dengue prevalence in males (10.5%) as compared to females (6.5%), and the highest positive cases (11.5%) were from the age group below 15 years, followed by the above 50 years age group. In Kathmandu, Sud *et al. (*2022) studied the epidemiological prospective of a focal outbreak of dengue infection, in which they found 2019 had the highest number of dengue cases, and among their study, 65.7% were dengue positive and 64.83% were NS1 antigen positive, similarly, only 5 were

IgM positive, and none were IgG positive. In a study done in Haraincha Village Development Committee of Eastern Nepal by Parajuli and K.C. (2016), the predominance of males was high (61.5%), and their major occupation was agriculture (45.9%).

Knowledge, attitude, and practices

Lack of proper knowledge and attitude about the causative agent, mode of transmission, symptoms, preventive and control measures, and practices might be the reason for the higher dengue burden. A study in Pakistan by Khan *et al.* (2020) 78.3% are aware of mosquito breeding sites, and 88.7% are aware that the role of government is important for dengue removal. A cross-sectional study was done by Selvarajoo*et al. (2020).* It showed that only half of the total participants had good knowledge (50.7%), 53.2% had a poor attitude, and 50.2% reported poor practice for dengue control. Among 85 respondents to the dengue seroprevalence study, 74.1% (n = 63) were positive for dengue IgG, and 7.1% (n = 6) were positive for dengue IgM. A study in eastern Ethiopia by Yusuf and Ibrahim (2018) found a moderate level of knowledge (49.5%), a neutral level of attitude (46.7%), and a moderate level of practice (52%). Nalongsack *et al.* (2009) in Laos found that they had fair knowledge about the vector (70.9%), a good attitude (94.3%), and (96.5%) knew they should visit a doctor when they suffered from it. In a study carried out in Peru by Elson (2020), a cross-sectional study was done. Approximately half (54.2%) of the respondents knew dengue was transmitted by mosquitoes, and 51.7% were able to identify fever and one other correct symptom of dengue; also, female sex was significantly associated with greater symptoms. In Jamaica, Shuaib *et al.* (2010*)* studied about knowledge, attitude, and practice, and found that about 54% had good knowledge about its signs and symptoms, like 49.5% having fever, 41.5% having aches, and 32.5% having pains(muscle pain, eye orbital pain), while 23% had rashes on their bodies. 60.06% were unaware of the transmission medium, 72.9% knew that standing water is a breeding place for mosquitoes, and the majority (77%) did not use effective dengue preventive methods such as screening of homes, and 51% did not use bed nets. According to Zamri *et al. (2020),* students in Malaysia had good knowledge about dengue; also, 100% of them had heard about dengue. The level of KAP towards dengue prevention, symptoms, and transmission was quite good. similarly, knowledge

and attitude towards dengue prevention were significantly correlated (p = 0.005). In a study in Vietnam, a total of 17.6%, 9.8%, and 6.6% of respondents reported frequently changing water, properly disposing of waste, and covering water storage containers to eliminate larvae (Nguyen *et al., 2019*). Hairi et al. (2003) conducted a cross-sectional study in the rular community of Kuala Lampur, and 82% knew that the cause of dengue is mosquito, but only 2.5% knew that it is caused by virus.90.5% were aware of the mosquito breeding site, and 93.3% cleaned the water storage body on a regular basis.70.5% used nets and coils for prevention. In a study in Bangladesh, Dhaka Rahman *et al.* (2022) found that students had exemplary DF knowledge (66.72%), attitude (89.28%), and practices (68.32%). Taksande and lakhkar (2013) conducted a study among dengue fever patients in a rural area of Central India and discovered that 76.58% were aware that the vector for dengue is a mosquito, and that 60.48% were aware of fever as a symptom. Regarding preventive methods, people were aware of mosquito coils/liquid (57.08%), spraying (35.12%), and cleaning the house (28.30%).74.14% of respondents were aware of mosquito breeding grounds.94.64 percent agreed that it was a serious illness. Khobragade and Meshram (2021) in a paper mentioned that 52.25% of people knew that dengue is spread by the bite of mosquitoes and 86.25% knew the breeding place of mosquitoes; here, only 12.5% know that Aedes is responsible for dengue infection.

National Context

Phuyal *et al.* (2022) cross-sectional study was conducted in six districts of Nepal, and the prevalence of KAP was seen, in which 74.1% obtained a high attitude and 21.2% obtained a high level of preventive practice on DF, among them symptoms of DF such as fever (91.7%) and headache (61.4%), as well as joint pain, skin rashes, and vomiting or nausea, which were considered symptoms. In cases of prevention, using nets in doors and windows (72.3%), eliminating standing water around the house (87.1%), cutting down bushes in the yard (86%), and preventing water stagnation (88.3%) were practiced. Dhimal *et al.* (2014), the study done in Central Nepal, found that 13% of people had good knowledge, 83% of the people had a good attitude, and 37% reported good practice. 99% knew that fever was Symptoms of fever, including aches, rashes, and nausea/vomiting, were seen. For prevention, households covered

water containers in the home (95%), cut down bushes in the yard (94%), eliminated standing water around the house (95%), and used mosquito coils (69%).

3. MATERIALS AND METHODS

3.1 Study Area

The study was carried out at Nobel Medical College Teaching Hospital which is located in Kanchanbari, Biratnagar-5, Morang District, Eastern Region of Nepal. Globally its position is latitude 26°28'23.2"N and longitude 87°16'18.9"E. Nobel Medical College Teaching Hospital (P) Ltd. an affiliated to Kathmandu University was founded in 2004.

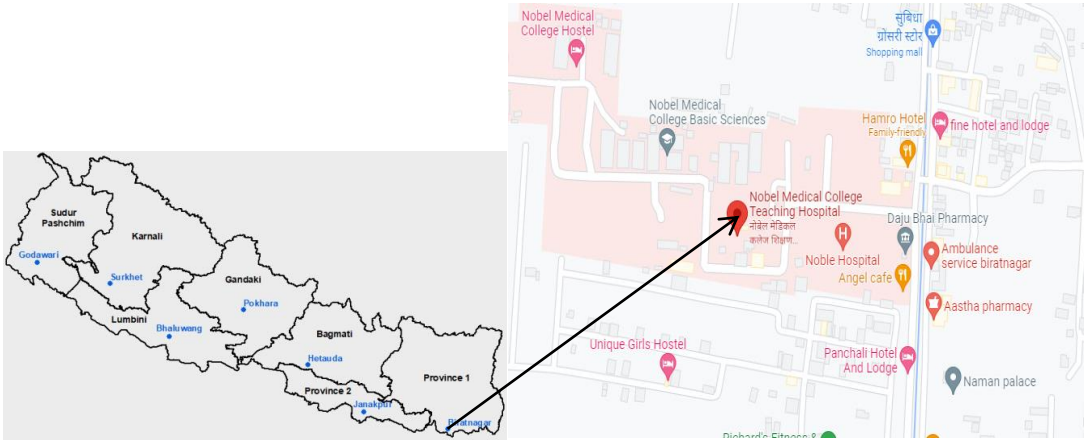

Fig 1.Location map of study area (www.googlemap.com)

3.2 Materials

3.2.1 Apparatus Required

Dengue Day 1 test kit (J.Mitra & co. Pvt Ltd), centrifugation machine, serum sample(70µl& 10µl for antigen and antibody test), syringe (Vacutech, Needle gauge 21G, stainless steel).

3.2.2 Chemicals Required

Antibody assay buffer pH(9.5).

3.3 Study Design

To fulfil the objective the study was divided into 2 phases.

1. Collection of the diagnosis and treatment data of all the patients registered in Nobel Medical College Teaching Hospital to determine the trends of prevalence of dengue.

2. Questionnaire survey to assess the knowledge, Attitude and Preventive Practices (KAP) of the TB suspected patients towards dengue

3.3 Methods for Prevalence of Dengue

3.3.1 Sample Size

A total of 1198 suspected dengue patients visited the Nobel Medical College Teaching Hospital in Morang, Biratnagar, Nepal. During the study period from the 15th of Jesth to the 5th of Kartik, 2076, having a high fever for 2-3 days (40°C or 104°F), a severe headache, pain behind the eyes, muscle and joint pains, nausea, vomiting, and rashes were included. For the structured questionnaire survey, a total of 56 patients who had given consent to participate in the survey were included.

3.3.2 Sample Collections

Blood samples of dengue suspected patients were collected from mid cuboidal vein of hand by the help of syringe. Those sample were taken in a test tube and put for centrifugation in 3000revolution per minutes (rpm) for 10 minutes. After centrifugation serum sample by the help of dropper were put in the Dengue Day 1 Test kit(RDT) by the help of Dengue antigen/antibody combi test kit manufactured by J.Mitra & co. Pvt Ltd, for diagnosis.

3.3.3 Dengue Rapid Diagnostic Test (RDT)

The RDT is a rapid diagnostic test to evaluate the presence of dengue antibody and antigen in the serum of suspected patients. Dengue RDT evaluated in this study are qualitative tests that detect dengue NS1 antigen, IgM, and IgG to dengue virus. Dengue virus RDT uses cocktails of dried antigen and colloidal gold-labeled monoclonal antibodies (for dengue NS1 antigen, IgM, and IgG antibodies) on a pad at the head of a nitrocellulose strip that is impregnated with either anti-dengue NS1 antigen, IgM, or IgG antibody lines. The result interpretation for all the RDTs was done visually with the naked eye, without the need for any specialized equipment or analyzer. The procedure of an RDT kit is that the test kits are brought to room temperature before testing, foil is opened to remove the cassette from the pouch, a sample is put in the specimen well of the cassette, 1 drop of buffer is added to the antibody well, and the timer is set. For confirmation of the results, it was left for 20 minutes, and then colored line(s) appeared. It is used for quick patient screening. A Dengue Day 1 test kit was used. Both antigen and antibody were tested for every

suspected sample since the kit was a dengue antigen and antibody combi test kit manufactured by J. Mitra & Co. Pvt. Ltd.

For NS1 antigen

NS1 tests detect the non-structural protein NS1 of the dengue virus, and this protein is secreted into the blood during dengue infection. It has been developed for use in serum. Two drops (70 l) of serum sample were added using a dengue antigen test sample dropper to the sample well of the antigen device, and then left for 20 minutes for reactions. Positive results used to appear within 2–10 minutes, but negative results must be confirmed at 20 minutes only, so it was left for that much time.

For IgM/ IgG antibody test

Immunoglobulin M (IgM) and Immunoglobulin G (IgG) antibodies are detected if the serum sample contains IgG antibodies to dengue; a colored line appears in the IgG test line region. Similarly, the IgM component, anti-human IgM, is coated in the IgM test line region. During testing, the specimen reacts with anti-human IgM. 10 l of serum sample was taken with the help of a dropper up to the label shown on the dropper, and then it was put in the device. A buffer was added to the device, and it was left for 20 minutes for the confirmation of the result.

3.4 Questionnaire Survey to Assess KAP towards Dengue

In order to assess the KAP analysis, information about positive patients was collected from Nobel Medical College Teaching Hospital, and a set of structured questionnaires was prepared. Due to the COVID peak situation, an in-person questionnaire survey couldn’t be performed. The address and phone number of the 137 positive patients were identified, and they were all approached. But only 56 patients had given their consent to participate in the survey. All 56 patients were administered the same structured questionnaire via phone call. Details about knowledge on dengue, like symptoms of the diseases, mode of transmission, and breeding site, were included in the questionnaire. The questions were intended to access the knowledge, attitude, and practice methods of the patients in relation to dengue fever.

3.5 Data analysis and Interpretation

The collected data was analyzed with the help of Microsoft Excel 10. The association between categorical variables was assessed by the chi-square test and Fisher’s exact

test, if the p-value was 0.05, it showed a significant relation, and if the p-value was > 0.05, it showed an insignificant relation. Thus analyzed data was interpreted by representing it with a table, pie chart, and bar diagram.

4.RESULTS

Dengue is endemic viral diseaseswith global estimates of 390 million infections per year in approximately 129 countries. In order to determine prevalence among suspected patients visiting NMCTH, present study was carried out using antigen/antibody kit during 15th of Jesth to 5th of Kartik, 2076. This study also assed the Knowledge, attitude and practice regarding dengue disease among the infected patients using structures questionnaire.

4.1 Prevalence of dengue at Nobel Medical College Teaching Hospital during Jesth to Kartik 2076.

A total of 1198 people visited the hospital with one or more dengue symptoms during the six months period. All the suspected patients were tested for dengue infection by using Dengue Day 1 Rapid diagnostic test (RDT) kit. Out of them 11.43% were found positive for dengue infections. Statistically there is significant difference of dengue infection in between positive and negative cases (X^2=59.5, P<0.05).

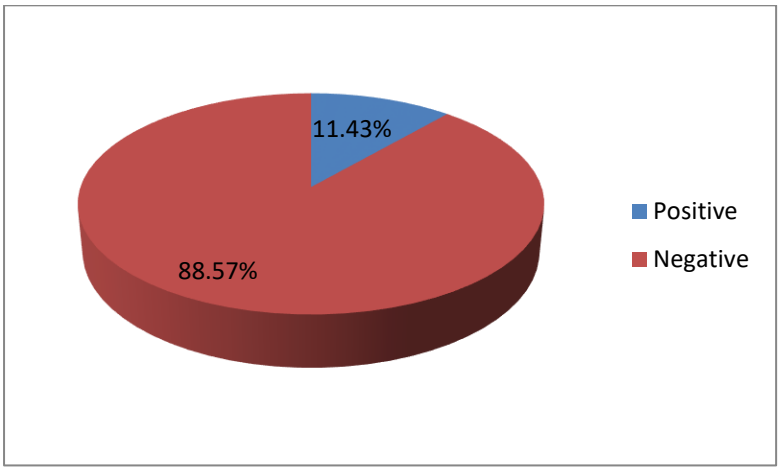

Fig 2: Prevalence of dengue by RDT among suspected patients in NMCTH

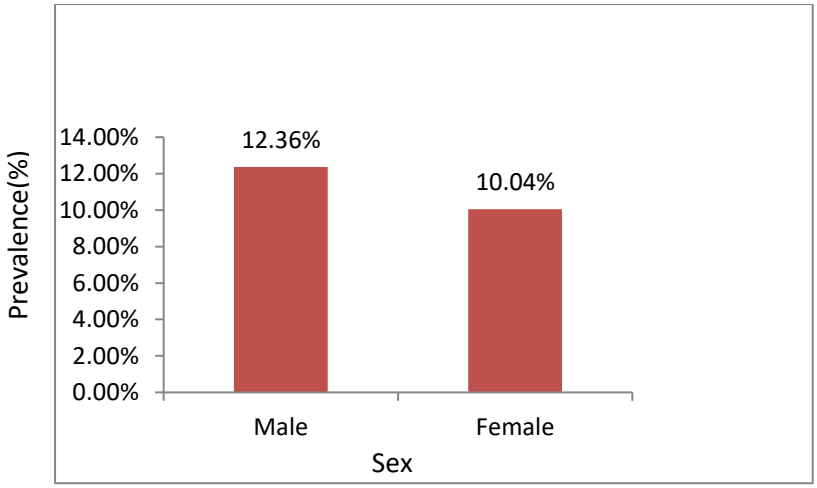

Fig3: Sex wise prevalence of dengue among suspected patients in Nobel Medical College Teaching Hospital

Among the total 1198 dengue suspected patients visited at Nobel Medical College Teaching Hospital male shows out of 720 suspected cases of , 89 suspected patients (12.36%)were found to be positive whereas incase of female, out of 478 suspected cases, 48(10.04%) suspected patents were found to be positive.Statistically there is no significant difference of dengue infection in between sexes ((X^2=0.22,P>0.05)

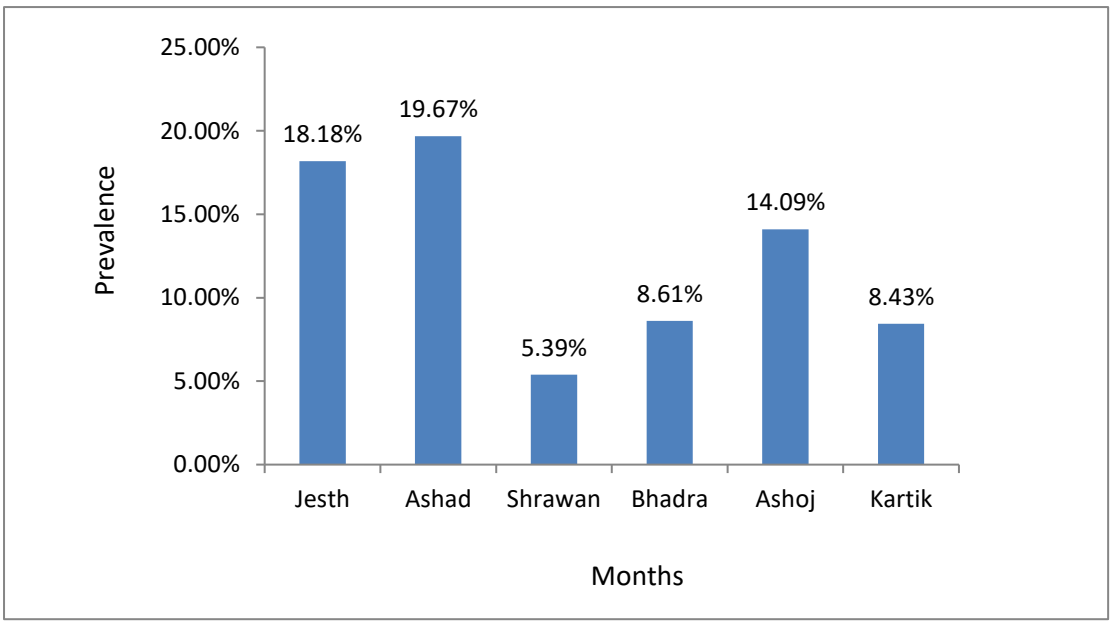

Fig4: Month wise prevalence of dengue among suspected patients of Nobel Medical College Teaching Hospital.

During the six month period maximum dengue positive patients among suspected cases were found in Ashad accounting for 19.67% during this month infection rate was very high.Comparatively higher member of suspected patients had visited

hospital during month Shrawan(371), Bhadra(209) and Ashoj(220) continued from 5.39% to 14.09% up to the month of kartik. Hence there is significant difference between months at ((X^2=13.56, P<0.05).

Table.1: Age wise distribution of dengue positive case in Nobel Medical College Teaching Hospital (N=137)

Age group(years)	Positive case	Prevalence(%)	P-value
0-10	22	16.05	0.040
11-20	16	11.67	
21-30	35	25.54	
31-40	31	22.7	
41-50	20	14.6	
>51	13	9.48	

Age wise distribution of dengue positive cases was found highest among 21-30 years age group i.e 25.54% and least among age group >51 age group was found to be 9.48% (Table no.1). In which 51-60 are 9, 61-70 are 3 and 70+ is only 1 in numbers respectively. Hence , statistically there is a significant difference between age groups at ((X^2=11.61, P<0.05).

Table.2: Prevalence of antigen/antibody test of dengue among positive cases in NMCTH (N=137).

Types	Positive case	Prevalence(%)	P-value
NS1 +ve	96	70	0.120
IgG +ve	8	6	
IgM +ve	25	18.2	
IgG+ve + NS1+ve	1	0.8	
IgM+ve + NS1+ve	6	4.2	
IgM+ve + IgG+ve	1	0.8	

Every suspected sample were analysed by the help of Rapid Diagnostic Test kit. All of the suspected patients were tested for NS1, IgM, IgG. Out of 137 patients tested positive for dengue infection. Maximum 70% patients had shown current infection with viral antigen NS1 positive. While 18.2% of had shown to be recent infection of dengue showing only IgM infection. Six percent of people had shown past infection. Intererestingly 4.2% of the people had both viral antigen and recent antibody (Table. 3).

Table.3: District wise prevalence distribution of dengue positive cases in NMCTH(N=137)

District	**Positive cases**	**Prevalence (%)**
Sunsari	74	54.03
Morang	53	38.7
Jhapa	2	1.45
Udayapur	7	5.10
Mahottari	1	0.72

During the study period, not only the local but also from various district visited this hospital with symptoms. Highest number of positive cases were eventually observed from Sunsari district 74(54.03%) followed by Morang 53(38.7%) was seen . The lowest prevalence of dengue was observed in patients from Mahottari district 1(0.72%). Among them people from five districts were found dengue positive.

Table.4: Ethnic wise prevalence distribution of dengue positive cases in NMCTH(N=137)

Ethnic group	**Positive cases**	**Prevalence (%)**	**P-Value**
Brahmin	55	40.14	0.0784
Chettri	33	24.08	
Janjati	18	13.13	
Muslim	3	2.18	
Madhesi	19	13.86	
Dalit	9	6.56	

As shown in table 5 ethnic wise prevalence distribution of dengue positive cases in NMCTH were mentioned. Ethnic group were determined by the help of positive case's surname. Highest prevalence was found among Brahmin 55(40.14%). Similary, Chettri (24.08%) and so on. But the lowest prevalence was found among Muslim 3(2.18%).

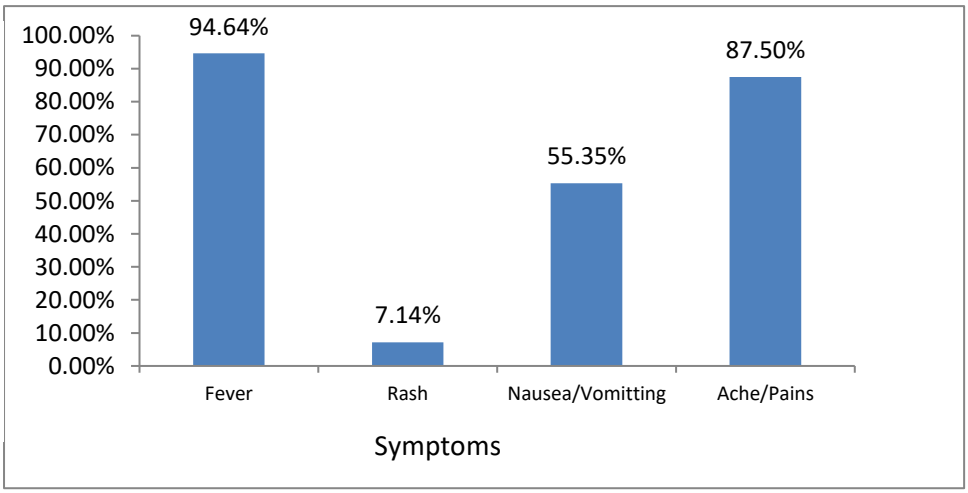

Fig 5: Symptoms of dengue among positive cases in Nobel Medical College Teaching Hospital

Among 137 positive cases, on the basis of their response, maximum patients 94.64% visited the hospital with high ever followed by 87.50% with various pains (eye, muscles, joint or bones). People also visited hospital with rashes found dengue positive.

4.2 Assessment of knowledge, attitude and practices regarding dengue disease among dengue patients.

Out of 1198 suspected cases in NMCTH,137 were dengue positives among them questionnaire survey was carried out for 56 positive cases by the help of phone call.

4.2.1 Knowledge of patients about dengue among positive cases in NMCTH

Since, all 56 patients were already infected with dengue, almost all the patients had knowledge of disease vector as mosquito (94.64%). Similarly all the patients were aware about vector breeding site and its preventive measures. Even 94.64% of them had good knowledge about vector, mode of transmission and control measures. But only few of them5.35% and 3.57% knew about the causative agent i.e the disease is caused due to virus and specific vector of the disease i.e *Aedes agypti*.

Table.5: Knowledge of suspected patients about dengue positive cases

S.N	Questions	Frequency(N=56)	Percentage(%)
1	Causative agent (Virus)	3	5.35
2	Diseases vector (Mosquito)	53	94.64
3	Vector species (*A.agypti /A. Albopictus)*	2	3.57%
4	Mode of transmission	53	94.64
5	Vector breeding site	56	100
6	Preventive measures	56	100
7	Control measures	53	94.64

4.2.2 Attitude of Patients about Dengue among Positive Cases in NMCTH

Regarding the attitude of the patients towards dengue among positive cases in NMCTH were good. They were asked about severness of dengue illness , 43(76.78%) said that it is serious , 19.64% said not serious and 3.57 were not sure about the severness. Regarding the responsibility of vector management 44.64% told about self responsibility to manage vector control whereas 21.42% said only government had responsibility but at the same time 33.92% agreed that it is both our as well as government responsibility of vector control. Management of breeding site to control dengue was investigated then 92.85% were agreed that by managing site dengue can be controlledbut among them 1.78% was actually not known. 100% said that there is role of community to control dengue vector.

Table.6: Attitude of suspected patients about dengue positive cases

S.N	**Questions**	**Frequency(N=56)**	**Percentage**
1	Severity of dengue illness a) Serious b) Not serious c) Not sure	 43 11 2	 76.78 19.64 3.57
2	Control measures of dengue vector a) Yes b) No	 53 3	 94.64 5.35
3	Responsibility of vector control? a)You b)Government c)Both	 25 12 19	 44.64 21.42 33.92
4	Management of breeding site to control dengue a) Yes b) No c) Not sure	 52 0 1	 92.85 1.78
5	Role of community to control diseases and vector a) Yes b) No	 56 0	 100

4.2.3 Practice of Patients about Dengue among Positive Cases in NMCTH

For preventive practices about dengue among positive cases were 33.33% . All of them used to cover drinking water pots but incase of regular cleaning of water bodies around only 41.07% agreed. All the patient 100% uses repellent. 55.35% patients uses of larva control strategy. Regarding wearing long sleeves 17.85% uses during summer. 55.35% usesfogging in order to remove vector and to be secured from disease. 16.07% people used repellent to the exposed body part to be safe from disease. 85.71% people believed that cleaning of bushes of surrounding can prevent growth of disease so they practiced cutting of bushes in the yard and near by houses.

68.28% patients used net screen in their doors and windows to get protection from vector entry so that they would not be affected .

Table.7: Practice of suspected patients about dengue positive cases.

S.N	**Questions**	**Frequency**	**Percentage(%)**
1	Drinking water pot covered	56	100
2	Regular cleaning the water bodies around	23	41.07
3	Use of repellent during Sleeping	56	100
4	Use of larval control strategies	31	55.35
5	Wearing of long sleeves cloth and long trouser	10	17.85
6	fogging the community	31	55.35
7	Use of mosquito repellent to exposed parts	9	16.07
8	Regular cleaning the surrounding	48	85.71
9	Use of nets in door and windows	36	64.28

5. DISCUSSION

Dengue cases are increasing throughout the tropical and subtropical countries of the world due to the shifting of the disease vectors. The present record indicates its distribution in 129 countries (Brady *et al., 2012*). Out of them, 70% of the burden exists in Asian countries (Bhatt *et al., 2013*). The majority of dengue cases are asymptomatic or mild and self-managed; due to this, the vast majority of cases are underreported.

The study conducted in Nobel Medical College Teaching Hospital, Biratnagar, showed that out of 1198 suspected patients, 137 (11.43%) had dengue-positive prevalence. Most of the dengue cases have been reported from Asian countries. Bangladesh had reported 21.37% (Mahjuba *et al.*, 2021), Pakistan 18.3% (Ali *et al., 2015),* Indonesia (84.96%), followed by the Phillipines (72.15%) (Tian *et al.,2022).* In an African country, dengue prevalence was reported at 15.6% (Simon*et al., 2019).* In Europe, dengue prevalence was 72.1% (Jelineck *et al., 2002).* In India, 24.6% had dengue prevalence (Chitkara *et al., 2018)*. Again, a study conducted in India found that dengue prevalence was 30.5% (Chakravarti *et al*., 2012).In Nepal, dengue cases were found to be distributed in both highland and lowland, compared to 41% in lowland (Dhimal *et al., 2014*). Also, in a cross-sectional study held in Dharan, Nepal, 37.6% of the population had dengue (Baral *et al., 2020).* Nearly 50% of the world's population had dengue, and among them, Southeast Asia and the Western Pacific countries are known to be the most endemic regions (Bhatt *et al.,* 2013). Most of the dengue cases reported from hospitals in Nepal, particularly private hospitals, were not found to be published. Dengue infection was found to be almost equally prevalent in males (32.1%) and females (30.6%) (Abud et al., 2022).But in Yemen, disease prevalence was higher among males (66.8%) than females (33.2%) (Ahmed *et al*., 2022). In the Phillipines, dengue prevalence was higher among males (56.7%) than females (43.3%) (Herbeula *et al., 2019*). Similarly, in Bangladesh, sex-wise prevalence was comparatively higher among males (11.97%) than females (9.4%) (Mahjuba *et al., 2021*). A hospital-based study in Bangladesh found a significantly higher prevalence of 72.5% in males than 27.5% in females (Abir *et al.*, 2021). In India, Punjab, a higher prevalence was seen among males (25.7%) than females (12.9%) (Chitkara *et al.*,2018).Prevalence of dengue reported in the southern part of

Nepal showed male (55% of cases) and female (45% of cases) (Neupane et al., 2014). But in Chitwan Medical College, Bharatpur, the prevalence of dengue among females was 57.8%, and among males it was low (42.2%) (Khanal *et al., 2021*). Again, in Chitwan, dengue infection was found to be almost identical in males (49%) and females (51%), according to a study (sah, 2021).Also, in the present study, dengue infection was found to be almost similar in both males (12.36%) and females (10.04%) at NMCTH.

In the present study conducted in Nobel Medical College Teaching Hospital, Biratnagar, the highest prevalence was seen during Ashad (19.67%). But a comparatively higher number of patients had visited the hospital during shrawan post-monsoon, mostly during the rainy season. In Korea, most imported dengue cases were identified from July to December, mostly during the rainy season (Je *et al*., 2016). In India, most dengue cases were seen in the monsoon and post-monsoon seasons during August to December (Sharma *et al., 2018*). A study held in Pakistan showed October had the highest (41%) (Khan *et al.,2022).* Prevalence In the central region of Nepal, disease prevalence was found to be high from August to October, with a high (59.45%) dengue case count (Paudyal *et al*. 2014). In Sudan, the highest (45.5%) dengue prevalence was recorded in the 21–30 age group (Elaagip *et al*., 2020). But in Japan, 46.5% prevalence was recorded in the age group of 31–45 years (Nalongsack, 2009). Similarly, in Lahore, Pakistan, the prevalence of dengue for the age group of 21–30 years was found to be the highest (23.14%) among all age groups (Ali et al. 2015) Also, in a study conducted in Rajasthan, India, the highest (35.90% prevalence) was seen in the same 21–30 age group (Pandey & Pandey, 2021). Similar results were seen in the study that was done in Nobel Medical College Teaching Hospital, Biratnagar, where the 21–30 age group had the highest (25.54%) prevalence. The reason would be that these people spend more time outdoors and thus have more chances of getting affected.

In our study, the prevalence of dengue with the help of the RDT kit NS1 was 70%, IgM was 18.2%, and IgG was 6%.. A high number of NS1 was seen in the patient, showing early detection of the virus. A study conducted in Sri Lanka with the help of rapid diagnostic tests indicated NS1 (43.26%), IgM (33.06%), and IgG (23.68%) (Tissera et al., 2014). In India, the Chattishghar RDT kit was used for dengue

diagnosis, and NS1, IgM, and IgG levels were found to be 18.9%, 18%, and 16.5%, respectively (Chandi,2020).A study in Nepal showed that an RDT test was done in which IgG, IgM, or both (IgM and IgG) antibodies and dengue NS1 antigen were 34.6%, 34.2%, 29.0%, and 24.1%, respectively (Sherstha *et al., 2020*). In 2019, there was a large dengue epidemic in Nepal. During this year, various districts, including Sunsari (19%), Chitwan (18.9%), Kaski (15.7%), Kathmandu (8.8%), Lalitpur (3.3%), and Jhapa (2.9%), were affected (Rijal *et al., 2019*). A study in Nepal showed dengue prevalence in Chitwan (92.85%) and Dang (58.2%) (Shrestha *et al.,* 2016). In a study in the western part of Nepal, the highest dengue prevalence was seen in Mahendranagar (13.3%), followed by Dhadhing (9.8%) and Dang (1.6%) (Shah *et al.,* 2012). In the present study, among district-wise prevalence, Sunsari (54.03%) had the highest percentage of infected people, followed by Morang (387.8%), Udayapur (5.10%), Jhapa (1.45%), and Mahottari (0.72%).

In the present study, it is seen that Brahim (40.14%), Chettri (24.08%), and List (2.18%) are Muslim. In another study done in Chitwan, Nepal, 69.9% of Brahmin were dengue-infected (Sah, 2021). A similar result was seen in our study, which shows 40.14% were Brahmin. This might be due to their awareness and hospital-seeking behavior whenever they feel ill; they are many and conscious of their health. In the western part of the Terai region, Nepal showed that positivity was higher in Brahmin/Chherti (13.1%) as compared to Janajati (5.6%) (Shah *et al., 2012).*

In Nepal, the majority of the participants were able to correctly identify general symptoms of DF, such as fever (91.7%) and headache (61.4%) (Phuyal *et al., 2022).* In a study in Pakse, Laos, fever was considered the main symptom of dengue (75.2%), followed by skin rash (18.7%) (Nalongsack *et al., 2009*). In Somalia, dengue symptoms were observed in participants and found to be fever (66.1%), aches (57.3%), nausea/vomiting (17.6%), and rash (32.2%) (Gaal and Mohamed, 2022). In Chitwan and Dang districts of Nepal, symptoms included fever (93.2%), ache (78.43%), nausea and vomiting (58.82%), and skin rashes (9.82%) (Shrestha *et al., 2016).* In the present study, we have assessed several parameters to test the practice of dengue patients in NMCTH, Biratnagar, regarding drinking water with the pot covered (100%), cleaning of water bodies (41.07%), use of repellents like mosquito nets and coils (100%), wearing of long sleeves (17.85), fogging (55.35), mosquito

repellent uses (16.07), cleaning of the surrounding (85.71%), and use of net in doors and windows (64.28%). Good practice among people was seen,

In the present study, we have assessed several parameters to test the knowledge of dengue patients in NMCTH, Biratnagar, regarding causal agents (5.35%), vector species (3.53%), and modes of transmission (94.64%). Disease vectors (94.64%), modes of transmission (94.64%), vector breeding sites (100%), preventive measures (100%), and control measures (94.64%) were known. In different countries, people's knowledge about dengue infection is considerable. The present KAP survey was conducted among the infected people, Hence, almost all the respondents had very good knowledge regarding the disease vector, vector breeding site, mode of transmission, preventive and control measures, but they had less knowledge about the vector species and causative agent. This may be due to their poor literacy rate. In Nigeria, most people had a good level of knowledge (87.8%) (Mansur *et al., 2021*). While in Vietnam, people were aware of infection (37.2%) (Nguyen *et al.*, 2019). Similarly, in Bangladesh, people had considerable knowledge about dengue (27.5%) (Sharmila & Habib, 2021). In Indonesia, 23.6% of respondents had fair knowledge about dengue (Martina *et al., 2018*). In central Nepal, 12.6% knew about dengue-infecting vector species (Phuyal *et al., 2022*). In the Caribbean region of Columbia, 25.4% of people knew about the dengue vector (Alexander, 2018). In Malaysia majority (97.0%) knew about disease vectors (Radman et al., 2013). According to a study conducted in Korea, 65% of the dengue vector was known (Im et al.,2019).In New York, the dengue vector species were *Aedes aegypti, Ae. albopictus, and Aedes polynesiensis* (Gubler, 1987). In a study that was done in Bangladesh, 31.1% of the participants knew that dengue is caused by female *Aedes aeygpti* (Sharmila & Habib, 2021). That is actually a huge number, but our present study shows that only 3.57% knew about the vector species. But in the case of Nepal female *Aedes aegypti, Ae. albopictus* is the only dengue vector seen, in which *Aedes aegypty is the* primary vector and the strains of dengue virus are DEV-1, DENV-2, DENV-3, and DENV-4 (Subedi et al., 2016). In our study, 94.64% of the participants knew about the dengue vector. Most people are aware that dengue is mostly caused by mosquitoes. In Pakse, 93.5 percent were aware of the disease vector and 93.9 percent were aware of the vector breeding site.(Nalongsack *et al.,2009).According to a Malaysian study, (89.3%) were aware of mosquito breeding sites (Radman, 2013).*A study conducted in

Somalia showed 77.4% knew that dengue is due to mosquito vectors; regarding vector species, 49.9% were aware; and regarding breeding sites, 54.1% were aware (Gaal and Mohamed, 2022). Similarly, a study seen in Dhaka shows that (97.86%) knew about the breeding site of mosquitoes (Mahjuba, 2021). In different countries, the general public's attitude towards dengue infection is mixed. In Indonesia, people's attitude towards dengue infection is neutral (49.3%) (Martina *et al., 2018*). While in Vietnam, it was found to be good (59.1%) (Nguyen, 2019). While in Nigeria, most people had a positive attitude (Mansur *et al., 2021*). Bangladesh indicates that the majority of general populations had a positive attitude towards dengue infection (Sharmila & Habib, 2021). In Laos, 70.9% knew the seriousness of disease, and only 30% agreed that it was our responsibility to control vectors (Nalongsack *et al., 2009).* In the present study, we have assessed several parameters to test the attitude of dengue patients in NMCTH, Biratnagar, regarding the severity of the disease. The majority of them (76.78%) feel the disease is more serious. Almost all the participants (94.645) thought the disease could be controlled by controlling the disease vectors. Most of the participants (44.64%) agree it is their responsibility to control disease vectors. 92.85% of people were aware that managing breeding sites helps control dengue. Almost all participants agreed the community should actively participate to control disease and vectors.

In different countries, various preventive measures were usedto get protection from dengue. Different countries apply different practice methods for dengue prevention; among them, Nigeria (76.6%) had good practices for protection (Mansur *et al., 2021*). In Indonesia, good practices were observed (68.2%) (Martin *et al., 2012),* in Vietnam (56.1%) (Nyugen *et al., 2019), and* in Bangladesh (34.2%) (Sharmila and Habib, 2021). In Nepal, commonly used preventive measures to reduce exposure to mosquitoes were covering drinking water pots (88.3%), cleaning water bodies (87.1%), using mosquito coils (63.6%), cleaning the surrounding area (86%), and using nets in doors and windows (72.3%) (Phuyal *et al.,2022).* In Pak, 20225% of people cover water pots, but only 10.02% change water bodies; however, 79.1% of people use mosquito nets for mosquito prevention (Nalongasack et al., 2009*).* In Pakistan, 92.1 percent of people covered their drinking water pots, 53.9 percent cleaned their water bodies, 59% used mosquito nets, 37% fogged their community, and 25% wore full sleeves for protection (Khan et al.,2022). In Somalia, 74% use

mosquito nets for protection; 17.6% keep the surrounding area clean; 30.5% use net in doors and windows; 20.3% fog the surrounding area; and 41.1% use repellent cream (Gaal and Mohamed, 2022).

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Among the total of 1198 suspected patients, 137 (11.43%) were found to be positive. In the case of sex-wise prevalence, males (12.36%) were more infected than females (10.04%), and during the six months of study, Ashad had the highest (19.67%) prevalence. Among the 21–30-year-old age group, people were highly (25.54%) infected, while older people were less infected. From Sunsari district, the highest (54.03%) prevalence was found. Additionally, findings of the study indicated that the majority of Brahmin (40.14%), followed by Chettri, and so on, were found highly infected. During the antigen/antibody test, NS1 had a high (70%) prevalence compared to others. The majority of patients had good knowledge about symptoms, the route of transmission, and vector breeding sites. Attitude was also satisfactory; similarly, practices towards the preventive measures of dengue were also good.

6.2 Recommendations

1. Local government should initiate community focused dengue awareness programme since Brahmin and Chettri caste group people are more infected than other caste groups.
2. In order to control DF in this province, vector control strategy must be launched as soon as possible.

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Appendix 1

Questionnaire for dengue patients

Name... Age…….. Sex……

Knowledge

1. Do you know about dengue?

A) Yes B) No

If yes, what are the symptoms of dengue?

a) Fever b) rash

c) Nausea, vomiting

d) Aches and pains (eye pain, typically behind the eyes, muscle, joint, or bone pain)

e)All of the above

2. Can dengue be transmitted?

a) Yes b) No

If yes, how does it transmit?

a) Houseflies b) Mosquito bite

b) Dirty drinking water d) Unhygenic food

3. Can dengue be transmitted by direct contact with another person?

a) Yes b) No

4. Which type/species of mosquitoes can transmit dengue?

(a) *Aedes* (b) *Anopheles* (c) *Culex*

5. Dengue symptoms is curable?

a) Yes b) No

If yes, how can we cure?

a) Drink plenty of fluid b) Paracetamol

c) Take rest d) All of the above

6. What are breeding place for mosquitoes?

a) Standing water b) Old tyers

c) Broken pots c) All of the above

Attitude

1. Dengue fever is…… illness?

a) Serious b) Not serious c) Not sure

2. Is it possible to control dengue infecting mosquitoes?

a) Yes b) No c) Not sure

3. Who is responsible for management of vector control?

a)You b)Government c)Both

4. Is managing mosquito breeding places a good strategy to control dengue?

a) Yes b) No c) Not sure

5. Have you attended any dengue prevention program?

a) Yes b) No

6. Communities should actively participate in controlling the vector?

a) Yes b) No

Practic*e*

1. Do you cover your drinking water pots?

a) Yes b) No

2. Do you clean or empty flower pots or water holding materialsregularly?

a) Yes b) No

3. Do you use net, coils or repellent during sleep?

a) Yes b) No

4. Do you use larvicidal oil/kerosene in coolers/drains to kill mosquito larvae?

a) Yes b) No

5. Do you wear long-sleeved shirts and long trousers to avoid mosquito bites?

a) Yes b) No

6. Is fogging of community is necessary?

a) Yes b) No

7. Do you apply mosquito repellent to exposed parts of your body?

a) Yes b) No

8. Do you cut down bushes in your yard or local park regularly to reduce mosquitoes?

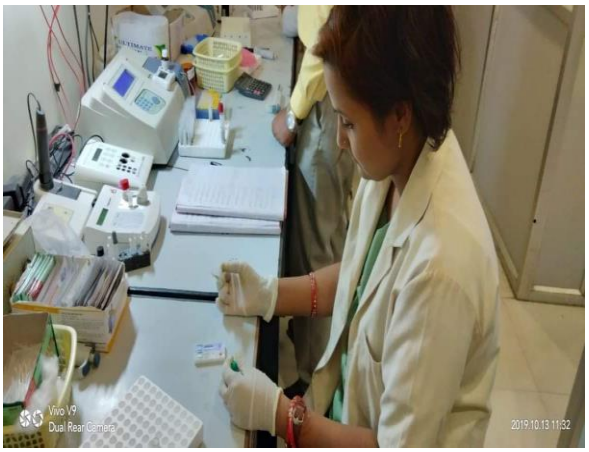
a) Yes b) No

9. Do you use mosquito screen on windows and outside doors ?

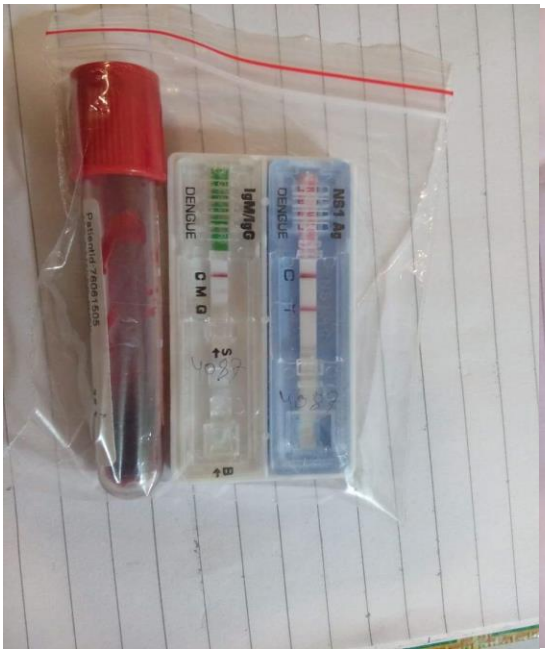
a) Yes b) No

Appendix 2

Sample showing NS1 antigen and IgM,IgG test



Sample testing



Sample showing NS1 antigen and IgM,IgG test

Rapid daignostic kit